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JOURNAL OF FORESTRY

VOL. XXXIII SEPTEMBER, 1935 No. 9

EDITORIAL

CULTIVATING OUR OWN GARDEN

"CULTIVONS nôtre jardin," said a great French writer. In homely Anglo-Saxon, tend to your knitting. It looks as though foresters will need to do some clear thinking about where their particular garden lies.

Most men are swayed, in spite of themselves, by emotions, preconceptions, habits, and prejudices. The art of advertising and the art of politics both utilize this fundamental fact of human nature. So-called "slogans"—catch phrases that short-circuit thinking—pass current like spurious coin. Too commonly we accept them without analyzing or even closely scrutinizing them.

Strictly, a slogan is a battle cry. The battles of politics are largely fought by spell-binding with words that stir to action through their concealed appeal to emotion or prejudice in place of reason. An example is the spell cast by the word "socialistic." To many it is primarily a term of opprobrium; it condemns, without need of further analysis.

To others (though fewer) "individualism" implies a like stigma. Foresters will do well to look below the surface of both epithets. We should not let our thinking be governed by mere words.

* * * *

As between general economic individualism, or preference for a minimum of governmental control of the pursuit and distribution of wealth, and a preference for public policies aimed at betterment of the common lot through an enlarged governmental conduct or control of business and increased social services, foresters, as foresters, are not lined up on either side. The matter does not lie in their garden. They are neither specialists in political science nor legislators, nor leaders in the field of general political action. Their viewpoints regarding the relative merits of the two broad courses of public policy may be influenced by conclusions reached in their peculiar field of knowledge and responsibility, but even so, if they enroll either for or against a new appraisal of the function of government, they do so as individual citizens, not as a professional body. Within their own field foresters should be capable of weighing proposals of policy on their merits, dissociated from external consideration or prejudices.

Public policies of forestry are being reshaped, and the field of activities has been suddenly enlarged. Under the New Deal, funds have become available for forestry work beyond anything that the most optimistic could have imagined possible three short years ago. There has been inadequate time for professional opinion to crystallize on the desirability

or the soundness of much that is being undertaken or proposed; and discussion tends to be colored by individual attitudes toward the New Deal as a whole.

The question of the scope and character of public activities necessary to make forest land and forest use contribute most fully to the national welfare should not turn primarily on the question of a general social philosophy. Fortunately, hitherto it has not been so regarded in the public mind. The plain logic of facts has brought recognition that in this field laissez faire breaks down. For nearly twenty years the leading representatives of the lumber industry have sought special measures of public aid. For much longer the weight of public sentiment has been on the side of governmental action to protect and perpetuate forest resources. Federal administration of the National Forests and state undertakings of permanent forest ownership and management for the benefit of the general welfare have no more been regarded as committals to a general doctrine of "socialism" than has federal operation of the postal service. Forest policies, whether old or new or merely proposed for discussion, should be judged on the basis of their probable fruits, not on the basis of political creeds either in favor of or opposed to more government in business.

* * * *

President Roosevelt, it is known, came into office with an already aroused and deep interest in forestry on its own merits, not merely as an incidental or accidental part of a broad social program. Nevertheless, forestry integrates so deeply in that program that its political fortunes are in danger of becoming welded to those of the whole New Deal undertaking. This exposure to the vicissitudes of party politics is made greater by the temptation to press the organization engaged in executing our national policies of forestry into service as a tool for party advantage.

It cannot be too emphatically reiterated that administration and the carrying of elections must be kept dissociated if administration is in the long run to perform its function faithfully and well. That the invasions of the forestry field by the political spoilsmen have outraged the convictions of many foresters is well known. In so far as the New Deal is concerned, political necessity has been the excuse. But it is not merely by placating the demands of politicians for berths on the pay-roll that the stability and single-hearted purpose of administration may be put in jeopardy. To make administration subservient to the support of the New Deal program as a whole would, if deliberately undertaken, insure destructive reprisals when political power passes to other hands.

The administrative performance of foresters in the public service must be judged and their fitness for their positions rated on the basis of their demonstrated competence to get prescribed results, not on the basis of how deeply they sympathize with the general purposes of the party in power. As administrators it is their duty to accept loyally and execute faithfully whatever program the policies of the party in power may ordain, or to quit. Officially they should be neither workers for the success of the Republican party nor workers for the success of the Democratic party; neither partisans of the New Deal nor partisans of rugged individualism; but foresters, cultivating their own garden.

* * * *

Hitherto, since the days of Roosevelt the First, the Chief of the Forest Service has been recognized as independent of party relationships. Recently legislation has been introduced which, should it become law, would make his appointment subject to confirmation by the Senate. This would place the position in the category of political offices as distinguished from those governed by the Civil

Service laws. Other legislation of a much broader character has been attached to a pending act; if not struck out, it will require Senate confirmation of all places in the Executive Government carrying a salary of $3,600 or more. Such a law would be a very disastrous setback to the merit system in federal adminstration. But if administrative organizations are to be used to keep in power those controlling the reins of government, or if bureau chiefs are to become officially identified with party purposes and counsels, their displacement when the Administration changes will seem logical.

The federal Forest Service has for thirty years been a pioneer in developing efficiency of public administration in this country. Gifford Pinchot began the good work. With most extraordinary vision and executive capacity, he both placed National Forest administration on enduring foundations of sound, far-sighted policy and created an administrative mechanism exceptionally fitted to the task of satisfactory business performance. The principles of good business organization were studied, and the methods then customary in the governmental establishment were critically scrutinized and overhauled to bring them as nearly as possible into line with up-to-date outside practices. Also, he inspired the organization built up by his hand and the aiding hand of Overton Price with a spirit of public service that has worked as a continuing leaven through the whole changing personnel body, as the years have run into decades; and the Forest Service still drives on the search for new and better ways of doing things in the interest of higher all-around efficiency. Its high place as a modern business organization is acknowledged by experts in the field of both public and private administration.

Business administration has become a recognized science, occupying its own definite field. Personnel administration is merely one of its subdivisions. But the principles of scientific business management, essential for the successful conduct of large-scale enterprises, can be applied continuously and effectively only by building up a trained corps of competent workers whole-heartedly devoted to their undertaking. This requires that the business of operating the government establishment shall be made a field for the life work of capable men and women, and that it shall be sharply separated from the field within which party victories call for the replacement of one set of high officials by another.

Cabinet officers must and should come and go. Their primary concern is with the definition of the policies of a particular Administration and the general direction of the agencies through which these policies must be carried out, not with running their Departments as business organizations. More often than not they lack the kind of previous training requisite to qualify them for the strictly executive task. They should have under them men qualified by long experience to operate the Departments on a high level of business efficiency, along the policy lines prescribed by the Department head and with full loyalty to him as the unquestioned source of major policy. This is the British civil service system, with permanent undersecretaries as operating chiefs and permanent staffs throughout, and with the whole public service a career service. Until we attain a comparable level of intelligent organization of the business of government here, the public interest will not be served with satisfactory efficiency. Fortunately, hitherto the federal Forest Service has been able to operate as a permanent career service, cultivating its own garden of efficient performance without subservience to the attainment of political and alien ends. Should that come to be radically changed, a less promising chapter in the history of forestry in the United States will open.

FORESTRY ASPECTS OF LAND PLANNING IN THE TENNESSEE VALLEY

By BERNARD FRANK

Division of Forestry, Tennessee Valley Authority

The past exploitation of the forests of the Tennessee Valley has not contributed sufficiently to the economic betterment of that region. Forest land planning, as an integral part of the Tennessee Valley Authority Act, has for its objective the full development of the forest resource for the benefit of the Valley's wood-using industries and communities. Since forests occupy over half the area, the opportunity for such planwise utilization is promising. The significance of forestry in the Tennessee Valley, the character of the forest resource, and the possibilities for permanent forest management are included in the forestry division's program as part of the regional program of the Tennessee Valley Authority.

FORESTRY must of necessity bulk large in the regional program for the Tennesee River Basin. The Tennessee Valley Authority Act provides for furthering the proper use, conservation, and development of the natural resources, and for bringing about the maximum amount of flood prevention and control, the maximum development of navigation, the proper use of marginal lands, and the proper methods of reforestation on suitable lands. These objectives clearly require that forests shall be given a new place in the economy of the Valley.

Some Consequences of Past Exploitation

The past development of the Valley's forest resources has been purely exploitative. More significant, perhaps, than the physical depletion of the resource itself have been the progressively undermining effects upon the region's economic structure. The greater part of the wealth derived from lumbering operations has only contributed to the further growth of already well-established urban and industrial centers outside of the Valley. With the exception of sawmill establishments, largely temporary affairs, relatively a small proportion of the manufacturing has been carried on within the region. Thus, of the more than 700 wood-using plants in the Valley, nearly 500 are sawmills, while only some 75 manufacture finished products. Outlets for local labor and opportunities for developing stable communities have thus been limited in many sections of the Valley. Furthermore, as the merchantable timber was cut out, the opportunities for even part-time labor in woods and sawmill operations have decreased.

The economic forces which have brought about these conditions are still operative, and even now the Tennessee Valley, while producing a surplus of raw forest products, must import a larger share of its finished products for lack of adequate regional manufacturing facilities.

Aside from the public forests, there is today no conscious effort to practice forestry in the Tenesnsee Valley. It may be fairly estimated that the annual growth of sawtimber in the Tennessee River Basin is at best 20 to 25 per cent of the annual cut. The findings of the Copeland Report relative[1] to the breakdown of private forest land ownership are particularly applicable to the Tennessee River Basin.

Despite years of clearing and abusive exploitation, however, the forests are still contributing to the many and varied demands of the Valley for timber products and still occupy more area than any other class of land. Of the total area of about 26 million acres, approximately

[1]A National Plan for American Forestry. 1933.

14,500,000 acres are forested, and an additional 3 million may be estimated as potential forest land.

In some counties forest industries are still the dominant and often the only type of industrial development. In fact, sawmills, planing mills, and woodworking establishments are widespread throughout the Valley, especially in eastern Tennessee, where nearly every town produces and exports some lumber. Chattanooga, first among the lumber and furniture centers of the Valley and one of the largest in the South, and Knoxville and Johnson City are important wood production centers.

In 1929 some 28,000 persons, or 11 per cent of the total number engaged in all manufacturing and mechanical industries, were in wood manufacturing establishments, and an additional 5,500 persons were in woods work. In the western North Carolina portion of the Valley the ratio was 33 per cent. In fact, of all the wage earners employed in the 221 manufacturing establishments in that section, nearly 60 per cent were engaged in forest products work.[2]

The forests have materially increased farm incomes. In 1929 the value of farm forest products cut for sale or home use in the Tenessee Basin amounted to $16,115,000, or $2.40 per acre of farm woodland.[3] This sum was one-twelfth the value of field and orchard crops for the same year. In western North Carolina alone the value of farm forest products was one-fifth of the value of field and orchard crops.

Indeed, in many wooded sections of the Valley, these past few years, practically the only cash income received by farmers has come from the cutting and sale of farm forest products. Such income has often spelled the difference between bare existence and adequate satisfaction of basic needs.

Forest products also contribute to the revenue of the railroads traversing the Valley. During the past five years they have constituted from 6 to as high as 50 per cent of the total tonnage shipments of the larger lines, while in the case of some short lines the ratio has run as high as 75 to 80 per cent.[4]

The chief reasons for this widespread industrial development in the past have been the large supplies of easily accessible raw materials and the close proximity to large markets within a radius of 200 to 300 miles. It is clear that the maintenance of continuous local supplies will be the dominant consideration in the future of the woodworking industries and of the many communities dependent upon the forest resource.

Relation of Forestry to Other TVA Programs

The initiation of the Tennessee Valley Authority's flood control and navigation programs has introduced many new problems, among others the readjustment of population to changed land use conditions brought about by the construction of dams and the consequent flooding of valuable agricultural lands. In addition to facing such special problems involving relatively very restricted areas, the Authority is also concerned with the working out of practicable solutions to the persistent problems of land misuse in the Valley as a whole.

Naturally, it has a direct interest in encouraging proper land use as a means of checking soil erosion and consequent silting up of its reservoirs. Moreover, the Authority is being looked to increasingly to assume the leadership in carry-

[2]Manufacturing Marketing Statistics, Bureau of Foreign and Domestic Commerce, 1932.
[3]Census of Agriculture. 1930.
[4]Based on special survey of railroad shipments.

ing out the regional aspects of the national land use program.

The proper utilization of lands for forestry purposes and the adjustment of the population pattern and of land use practices to changing social needs is inextricably bound up in the solution of these problems. Hence full consideration is being given the role of forest lands, present and potential, in this program.

General Planning Organization.—To coordinate the activities of the various planning divisions of the Authority—the agricultural division, the industrial division, the land planning division, the engineering planning and geology division, the social and economic division, and the forestry division—a planning council has been created, consisting of heads of the above divisions and a chairman-secretary.

Within the forestry division, planning centers in the section of management planning. (Other sections are: planning, concerned with the work of the TVA-CCC camps; development, concerned with administration of TVA forest lands, tree crop development, game management, and forestry education; and administration, headed by the chief forester.)

The functions of the forest management planning section are: (1) The coordination of forestry with the regional land use program of the TVA, (2) broad forest land classification, (3) semi-intensive watershed studies, and (4) preparation of detailed management plans for forest areas in TVA ownership.

Forestry and the General Land Use Program

The navigation and flood control programs, involving problems of transportation, communication, and industrial and population readjustment, all affect the future utilization of the Valley for forestry. From the broader regional standpoint, the use of land for forestry will depend on the needs of the Valley for watershed protection, timber supplies, wildlife, and outdoor recreation facilities.

Construction of dams with consequent flooding of good agricultural land and isolation of agricultural areas, such as

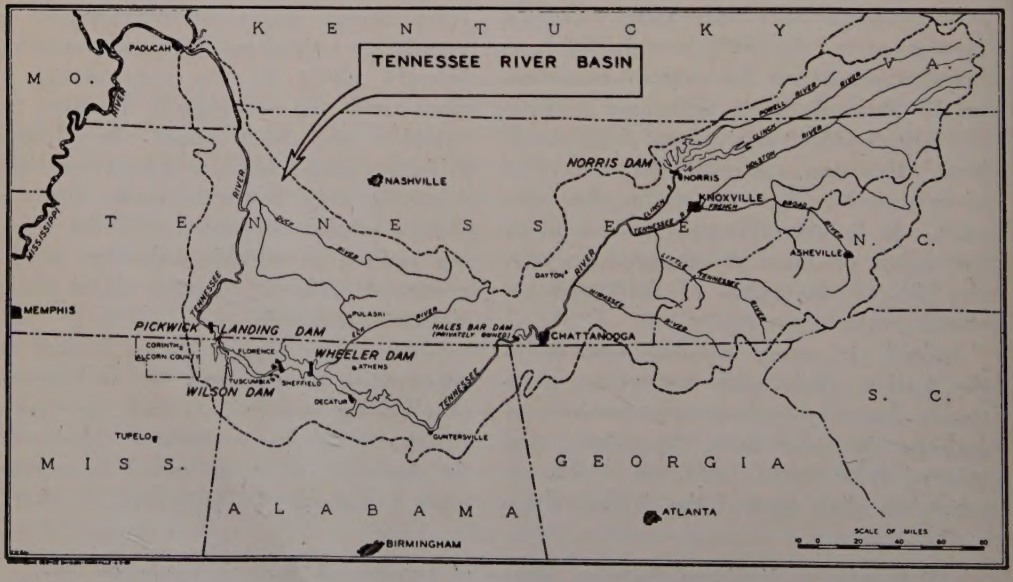

Fig. 1.—Map of Tennessee Valley, showing drainage and present and potential dams and reservoirs.

characterizes the situation above the Norris Dam, immediately changes the entire pattern of land use and makes forestry or other non-agricultural uses possible where otherwise they might not be considered.

Forestry, as a means of supplying raw materials, is also a factor in determining the extent to which wood-using industries may develop in the future. Thus the development of large-scale wood-using plants, such as pulpmills, in the Tennessee Valley is definitely linked to the occurrence of pulpwood species transportable at favorable freight rates. To illustrate: The production of newsprint from southern yellow pine, if economically feasible within the confines of the Tennessee Valley at all, can only be undertaken in the southwestern part of the basin. Elsewhere in the Valley the supplies of pine are relatively too limited and too scattered, and are already being utilized by small operators for lumber, etc. Opportunities for the development of small wood-using plants are much brighter, since they are in much better position by reason of their individually small capacities and their small-size equipment to utilize efficiently the large supply of low-grade timber available. In fact, a recent survey of the possibilities of establishing or expanding such plants in the upper part of the Valley showed that the least problem was the raw material supply.

In general, this phase of the forestry program will receive increasing emphasis as the other phases of the regional program develop.

Valleywide Forest Land Classification

Logically, the first step in working out a well-balanced forestry program for the Valley is that of orientation, requiring the location and classification of present and potential forest lands. These include wooded areas, badly eroded lands, and other open lands clearly unsuited to further agricultural utilization. The relative distribution of these lands varies in different proportions of the Valley, but, by and large, every section contains areas which should be maintained permanently in forest cover. For the Valley as a whole, the area of present and potential forest land is estimated at over 62 per cent of the total area. (Table 1.)

Table 1 gives an approximation of the present and potential forest land area in the Valley. No satisfactory figures are yet available for an accurate estimate of the future utilization of the forests for their various primary purposes, but a

Table 1

DISTRIBUTION OF PRESENT AND POTENTIAL FOREST LAND IN THE TENNESSEE VALLEY, 1934
(Subject to revision)

Unit	Total Valley area	Present and potential forest area			
		Total	Farm woodlands	Forest land not on farms	Submarginal and eroded land which should be in forest[2]
Thousand acres	25,767	16 050[1]	5,860	8,690	1,500
Per cent	100	62.2	22.7	33.7	5.8

[1]Undoubtedly, some lands now in forest cover will in the future be found more suitable for agricultural production, thus reducing the total forest area by perhaps 1 5 million acres. This has been taken into account by halving the estimate of 3 million acres of submarginal and eroded lands which it is estimated will revert to forest.

[2]Some of this land will remain in farm ownership as woodlands.

rough estimate may be offered as follows:

Primary use		Acres
Total future forest area		16,050,000
Recreational areas (especially parks)	750,000	
Watershed protection areas	300,000[5]	
Game breeding and refuge areas	100,000	
Miscellaneous non-timber producing areas	100,000	
		1,250,000
Area available for timber production primarily		14,800,000

The relative distribution of forest cover over the Valley as a whole is shown in Figure 2. Figure 2 indicates three major forest regions: (1) The North Carolina and North Georgia section(including some 250,000 acres of old growth timber, mostly in large ownerships), (2) The Cumberland Plateau section, extending from Morgan County in the north in a southwesterly direction down into northeastern Alabama, and (3) an area lying in the western portion of the Valley, in Tennessee and in northwestern Alabama. Within these three areas forestry is clearly indicated as the dominant land use. The U. S. Forest Service is in process of acquiring large areas (in western North Carolina), and the board of directors of the TVA has recommended to the Secretary of Agriculture that considerable purchases be made in the other two regions. Figure 3 shows present National Forest purchase units, approved purchase units, and areas recommended for acquisition by the TVA Board.

The widespread occurrence of serious erosion throughout the Valley constitutes another problem in land adjustment. The extent and character of erosion vary so greatly from locality to locality that to gain a really adequate picture of its occurrence and seriousness it would be necessary to prepare large-scale maps permitting the location of eroding areas as small perhaps as 1-5 acres.

The above should be kept in mind,

TABLE 2

PRELIMINARY LAND CLASSIFICATION OF CLINCH-POWELL WATERSHED, 1935[1]

Type and condition of land	Total watershed area Acres	Area above Norris Dam[2] Acres	Area below Norris Dam Acres
All land	2,782,400	1,852,400	930,000
Cleared land	1,241,500	916,500	325,000
Crop	[3]	440,600	[3]
Pasture		419,000	
Idle and abandoned		56,900	
Forest land	1,486,800	885,800	601,000
Sawtimber[4]	1,056,600	499,600	557,000
Cordwood[5]	363,000	319,000	44,000
Below cordwood	67,200	67,200	———
Other			
Urban, roads, etc.	19,100	15,100	4,000
Norris Lake	35,000	35,000	———

[1]Based on general field reconnaissance supplemented by aerial photographs.

[2]Figures on distribution of land use classes obtained from preliminary report of forest survey of Clinch River watershed by U. S. Forest Service. Distribution of condition classes based on field reconnaissance.

[3]No data prepared.

[4]Minimum of 1,000 board feet per acre in trees 14 inches d.b.h. and over.

[5]Minimum of 4 cords per acre in trees 6 inches and over d.b.h.

[5]Also available for recreation and wildlife.

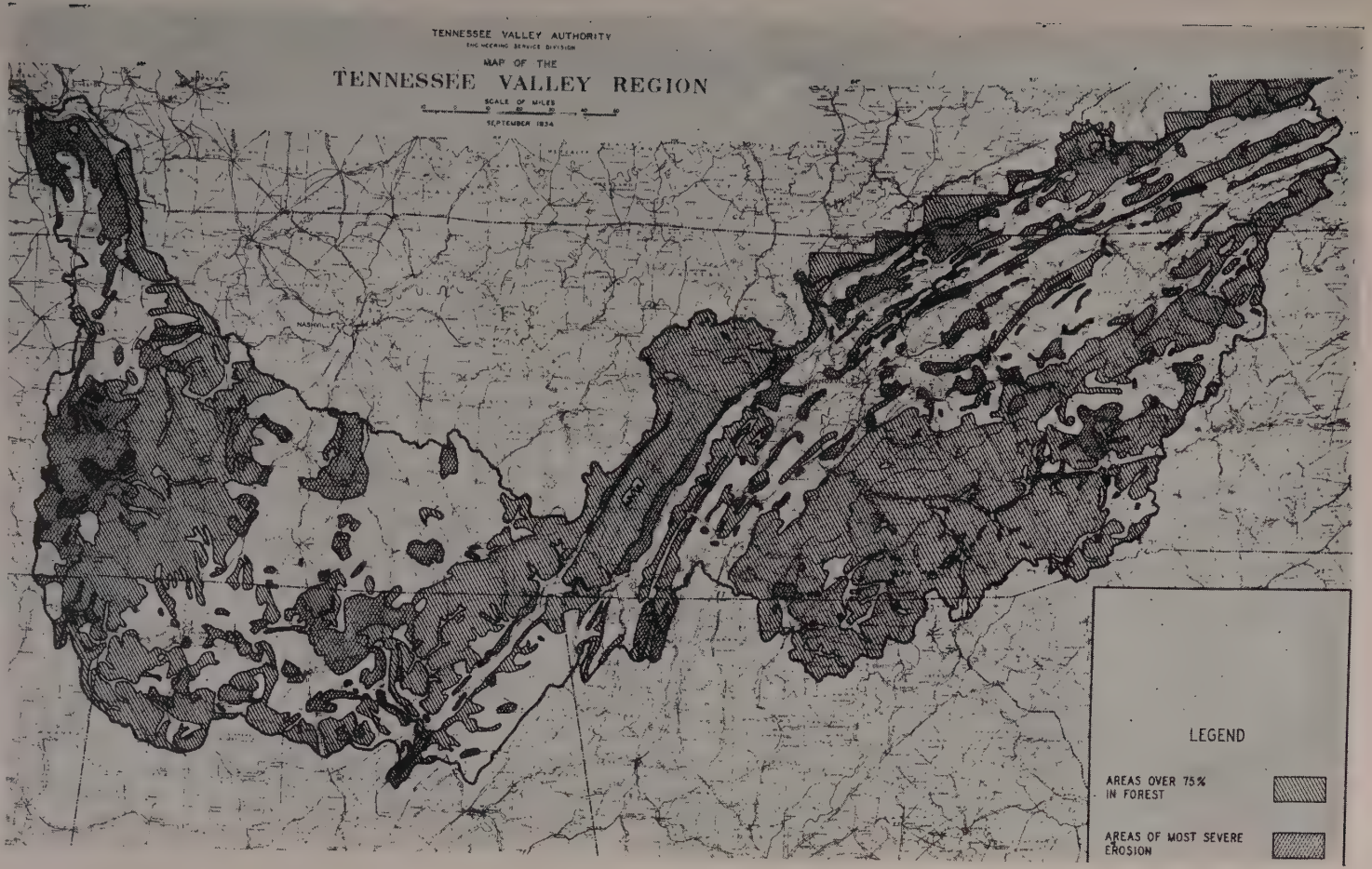

Fig. 2.—Map of valley showing major forest areas and most seriously eroded areas.

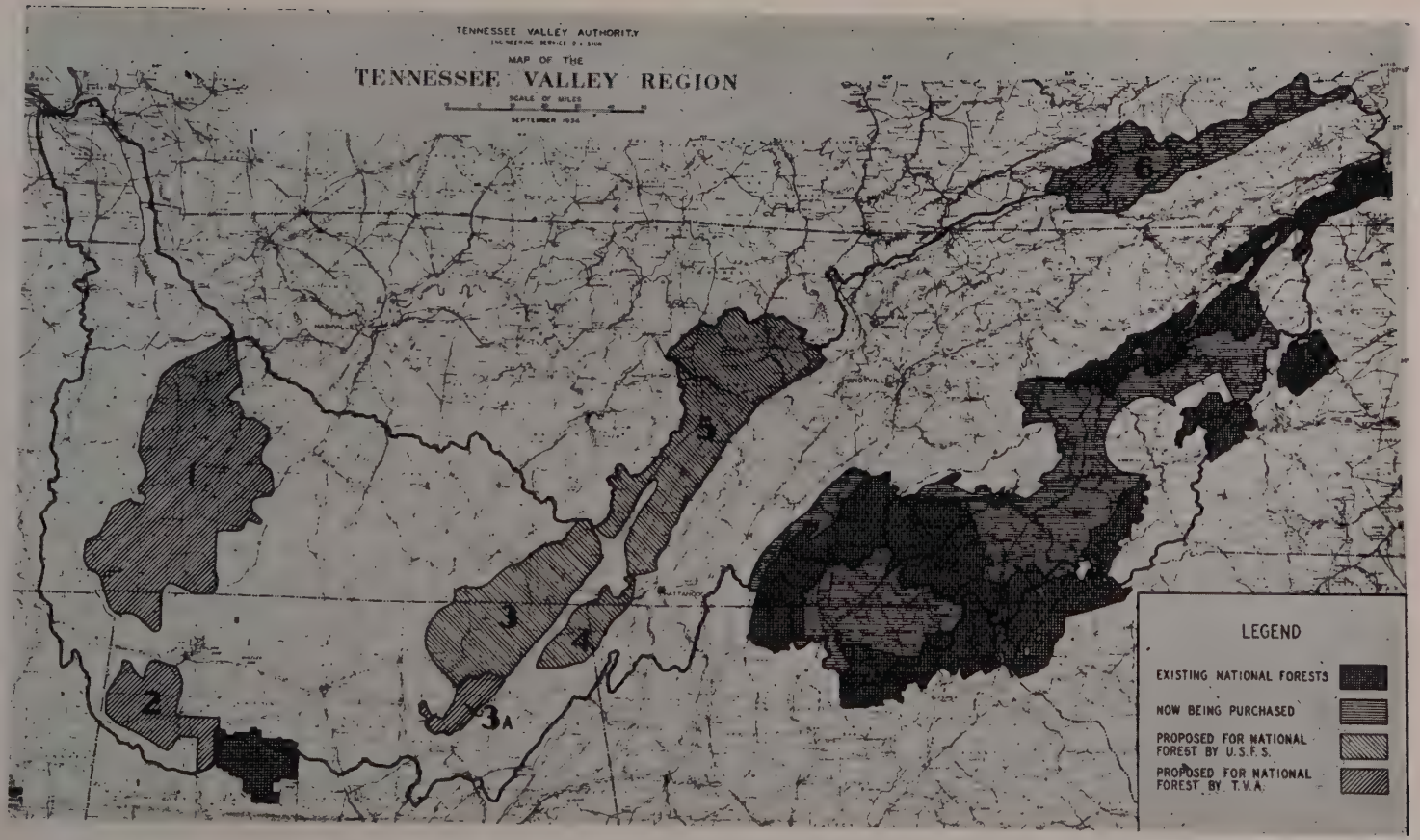

Fig. 3.—Map of valley showing present and proposed National Forest Purchase Units. The large figures designate the several proposed new units. No. 1 is the Duck River Unit; No. 2 an extension of the Alabama National Forest; No. 3 the Scottsboro Unit; No. 3(a) an extension of this unit; No. 4 the Sand Mountain Unit; No. 5 the Chattanooga Unit; and No. 6 the Clinch Unit.

therefore, in studying Figure 3, which indicates very broadly the relationship between erosion and the distribution of forest cover. Except for a few small areas in the western part of the Valley and portions of East Tennessee, where because of heavy overcutting and repeated fire damage erosion has occurred on forest lands, practically all of the erosion is confined to cleared lands.

Further data on eroding areas and on forest cover, type, and condition, and on forest land ownership and forest utilization, are now being obtained as part of the valleywide classification, thus permitting future concentration in areas of special concern. General reports and maps will be prepared for each county in the Valley, on the basis of which such concentration can be facilitated.

Semi-intensive Watershed Surveys

Contemporaneously with the broad classification of forest lands over the Valley as a whole, a survey is now under way of the Clinch-Powell watershed, one of the major drainage basins. (Figure 1.) This watershed was selected first for semi-intensive study chiefly because the construction of the Norris Reservoir, into which the Clinch and Powell Rivers drain, has made urgent its early examination. Table 2 shows the approximate distribution of cleared and forest lands.

This classification is being made with the aid of aerial mosaics and planimetric maps, permitting the accurate location of all forest areas by type and condition classes and the recording of ownerships of large tracts.

In this connection, an inventory was made of wood-using plants and other consumers, including such factors as sources of supply, kind and quality of raw material purchased, drain, and types of products manufactured, as one basis for determining the present capacity and the future industrial possibilities of the watershed. The field work on this phase of the study is now complete.

Detailed growth and volume data have been obtained by the U. S. Forest Service in its timber survey of that part of the watershed above Norris Dam.

In the course of the Clinch-Powell watershed survey, a number of areas were noted which by reason of eroding condition, topography, soils, and stage of development could be classed as "problem" areas. From the forestry standpoint, only those areas were considered which were so badly eroded, or of such character physically, or both, as to preclude their economic reclamation for agriculture. The factors given most weight in the selection of these "problem" areas were slope gradient, erosivity and fertility of soil, and the reflection of these factors in the social and economic status of the locality.

Five areas within this watershed have been selected for possible acquisition as submarginal tracts, and on one of them the AAA is now making acquisition surveys. In this connection, the following suggestions are offered to facilitate the program:

(1) Buy up the submarginal areas without attempting immediately to move out the people whose properties are purchased. A certain percentage will leave voluntarily, but the larger portion will undoubtedly remain for the time being for want of better places to go to.

(2) Redistribute the remaining people on small tracts of five to fifteen acres per family, to be utilized by the people temporarily remaining for the production of food crops for home consumption.

(3) At the present time large portions of the population of submarginal areas are on relief and will continue so until economic conditions improve. To provide useful work projects, lay out an intensive forest developmental program

covering the next few years. On the basis of such program, arrange for appropriations to the land-using agencies concerned to provide part-time work to that portion of the surplus population now on relief rolls. These funds should be in addition to the regular annual funds required by the administrative agency for the long-range development of the area.

The above interim program will serve three useful purposes:

(1) It will give the surplus population not needed as a permanent labor force ample time to move to new locations or to get jobs in other communities and in industries as economic conditions permit.

(2) By relieving the pressure for immediate activity upon the rural resettlement agencies, it will allow more time to examine, locate, and select desirable rehabilitation projects.

(3) It will provide the large labor force needed in the early stages of rebuilding the badly eroded and devastated areas acquired. By the time this interim phase of the program is well under way and the need for a large labor force is less urgent, enough time should have elapsed to make it possible to re-absorb the surplus population elsewhere in industries or in resettlement projects.

Summary and Conclusion

The study of the relation of forest land to the requirements of the Tennessee River Basin for watershed protection, raw materials, extensive outdoor recreation, and the other goods and services obtainable from forest lands is an integral part of the regional program of the Tennessee Valley Authority.

As a step towards fulfilling this part of the regional program, the division of forestry is conducting the following activities:

1. Forestry and the regional land use program.
2. Valleywide forest land classification.
3. Semi-intensive watershed surveys.
4. Preparation of management plans for specific areas.

The above activities may be said to have two objectives: (1) the preparation and application of plans leading to the development of the forest resources of the Tennessee River Basin in conformity with the broad purposes of the TVA act and (2) the fulfilment of the regional portion of the "National Plan for American Forestry" developed by the U. S. Forest Service and approved by the National Resources Board.

To what extent these objectives will be fulfilled depends largely on the sympathetic response of the people of the Tennessee River Basin and of the nation at large to the broad purposes set forth in the Tennessee Valley Authority Act. Already there has developed a new awareness of the social significance of proper land use. The knowledge that we are now nationally in a critical phase of the problem of land utilization should lead to a willingness on the part of both planners and the people to face realistically the issues involved and the corrective measures to be applied. To do so we must look forward rather than backward; strip out thinking of outmoded shibboleths; in short, adopt a social engineering approach to the problem.

In a subsequent article the practical application of land planning by the TVA forestry division to a specific working circle will be described.

SHELTERBELTS IN THE STEPPES OF RUSSIA[1]

By G. N. VYSSOTSKY

Kharkov, Ukraine, U.S.S.R.

For many years Russian scientists have experimented with shelterbelts in a region similar to our Plains. The author is a venerable member of this group of scientists and is highly regarded as the originator of scientific shelterbelt technique and as an investigator of the effects of such protective plantings. In this article he discusses the effects of shelterbelts on wind amelioration, on the fixing of driving snow and sand, on the soil moisture, and on the crops in the protected areas. His article answers many questions raised by foresters not familiar with the subject.

PROTECTIVE forests in the plains may be planted either in large tracts or in strips.

If a large forest tract be located in a humid region through which moisture-bearing winds move toward the arid inland area, such a forest tract should theoretically be capable of increasing the moisture supply in the leeward dry region. The forest evaporates the moisture which condenses on its crowns plus that which is drawn up by the roots from the ground water and thus returns an increased quantity of water to the air currents coming from the ocean. Brückner has previously pointed out this fact. If the moisture-bearing winds penetrate further inland into dry regions, it is apparent that such forests have a beneficial effect on the climate of the dry regions. This, of course, holds true providing there is no intervening mountain range to intercept the moist air currents.

I introduced this idea of the transmissive role of the forest in my article published in the Russian *Journal of Forestry* of 1911. Apparently Mr. Zon has made use of this article, adapting my ideas to the conditions of the United States of America and quoting entire paragraphs without mentioning their author. But I did not extend my theory to arid localities.

In the arid regions of the temperate zone, the forest usually gives way to Steppe or Prairie because the forest requires more water and a lower concentration of salts. From the early days of my activity I have been interested in extensive experiments in establishing forests in the Russian Steppes under the unfavorable conditions of insufficient moisture and alkaline soils. I came to the conclusion that a forest growing under such handicaps is not healthy; it degenerates eventually and becomes a breeding ground for countless parasites, both insects and fungi. Ordinarily, this takes place at a certain critical age—15, 20, 30, or 40 years, depending upon the moisture of the soil and degree of its salt concentration. To overcome the drying out of the artificially introduced forest in the Steppe region, it is necessary to lower the rotation to this critical age of 15, 20, 30, or 40 years, depending on the climate and soil.

In an arid locality a forest greatly decreases and even prevents surface runoff. Water intercepted by the forest evaporates almost entirely. The vapor is carried away by winds, for the most part blowing from the arid region toward the moister region in contrast to the above discussed moisture-bearing air

[1]Translated from the Russian by Oleg Maslenikov and M. Dobrotin, Berkeley, Calif. Figures by M. Dobrotin from author's sketches.

currents which blow toward the drier area.

The water supply of the forested area will vary depending upon the soil conditions. If impermeable treeless soils develop a greater water-holding capacity through afforestation, then the region will gain in moisture content because more water will be saved by the decreased surface run-off than will be lost through transpiration by the forest crowns. The net result is an increase in ground water and normal stream-flow. This increased water content may be especially pronounced in mountainous regions where the forest captures water through condensation. If, however, the treeless soils are permeable, with little or no surface run-off, it is possible that afforestation will result in a decrease of total moisture in the region because of the additional loss of water through transpiration by the forest. This will lead to a decreased flow of the streams and rivers draining the forested area. Consequently, the cutting of the forest under such conditions will increase the normal stream-flow. This is particularly true in the case of highly porous sandy, gravelly, or rocky soils, such as apparently occur at the American Wagon Wheel Gap Station.

Forest Strips

In the U.S.S.R. we have given up planting forests in large bodies in the Steppe region. Shelter belt planting is a different matter. It is frequently resorted to in the Steppes where blizzards occur. The snow is carried along by the wind; coming in contact with a forest thicket it is deposited in snow drifts at the edge of the thicket. Such drifts occasionally reach large dimensions, up to 154 and even 350 cubic meters of snow per linear meter. This snow furnishes an added supply of moisture, as a result of which the growth of the plantation in moderately wide strips turns out better than in the large tracts. In addition, the roots of the trees and shrubs of the strip penetrate into adjacent fields for a distance of up to 10 meters or more to obtain additional moisture. The isolated strips are not as susceptible to parasitic infection as a large body of forest. Also, it is possible to plant strips along ravines, where the soil is more moist and leached, hence providing better conditions for the growth of the forest plantation. The disadvantage of strips, especially those less than 10 meters wide, is the drying out of the upper soil horizons due to the penetration of dry winds and invasion of weeds and grasses. To moderate these influences it is necessary to create dense forest fringes and to introduce into the plantation a thick underbrush. (See my article "How to Propogate Forests in Our Steppes and How to Take Care of Them.")[2]

In general there is no doubt as to the beneficial effects of shelter belts. Their snow-collecting capacity is of great importance to roads, farmsteads, and settlements; they serve as protection from snow drifts, blowing sand, and to some extent from dust as well as from strong winds. Likewise in some cases they can be used as a protection of cultivated areas; also for encircling ravines, so as to protect the plantations along the steeper slopes and keep the snow from being blown down into the valley. Of all these the most important seems to be the protective action of shelter belts upon neighboring cultivated areas.

Protection of Cultivated Areas

Foresters have long observed that in forest nurseries surrounded by protective forest plantations the seedlings and trans-

[2]Reviewed by S. R. Gevorkiantz and H. F. Scholz. Jour. of For. 32:358.

plants next to the edge of the windbreak do not develop so well as do those planted further away. Thus there occurs a gradation in the size of the plants, the poorest growing in the immediate vicinity of the shelter belt strip (due in part to the shade and the reflected light, but principally to the drying up of the soil by the roots of the shelter belt trees spreading under the nursery beds). Occasionally also the stagnation of air movement has some detrimental effect, especially in places where the cool air settles over low ground, forming frost pockets. Further away from the windbreak the seedling development reaches an optimum, after which it again decreases where the influence of the protective strip decreases. Such a phenomenon is observed also in orchards. For protection against frost damage an open border should be maintained in the lower portion for the escape drainage of cooled air. To reduce the shading one should cut off the overhanging branches, while to diminish the drying by the roots a ditch should be dug not more than 1 meter in depth between the protective strip and the nursery beds, and a bank of loose earth piled towards the edge of the windbreak trees. It is wise to lay out roads between the protective strips and the cultivated areas. Great care, however, must be taken to keep them free from weeds.

In studying the influence of shelter belt strips intended to protect cultivated fields, the nature of snow drifts should be observed. A profile of a protective strip is pictured in Figure 1. The arrow on the right indicates the direction of the wind which tends to blow the snow off the fields. Within the plantation are three forms of incipient deposits of the snow drift. As is evident, the mound of snow begins to the windward side of the tree belt, and forms a tail, A. Further on, the snow drift penetrates into the shelter belt, builds higher and higher on an angle which depends on the density and the pattern of tree branches and on the strength of the wind. In young plantations the snow drift, having reached a comparatively small height, does not rise any further but becomes abruptly cut off, as at B. On the leeward side of the shelterbelt the snow drift usually terminates abruptly, C, and immediately merges into the lower sloping tail, D, which spreads beyond the boundaries of the shelter belt and blends with a normal snow cover, E, that exists because of the protective belt of trees.

The drift itself, A-B-C, is usually formed by the so-called "ground blizzard," i.e. by the snow which consists of the more or less compacted particles which the wind is unable to raise into the air and therefore instead propels them along the surface of the frozen ground. These heavier snow particles are easily stopped by barriers, and start the embankment of the more compact snow of a specific gravity as high as 0.4 to 0.5. When the entire supply of

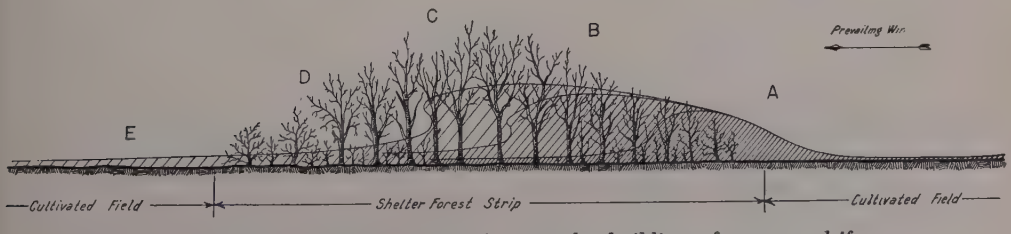

Fig. 1.—Profile of a shelter belt, showing the building of a snow drift.

"ground" snow gives out the drift breaks off abruptly, C. The other and lighter part of the drifted snow is piled up by the wind, for the most part by the lower currents. On entering the plantation the air currents are retarded and the snow begins to settle down.

The particles of this "upper blizzard" are carried further than those of the "ground blizzard," and form the above mentioned tail, D. If the snow-absorbing strips be narrow or the drifts be very large, the main drift formed by the ground wind will merge on the leeward side of the strip into the adjacent field and lose the precipitous break, C. Sometimes tongues are formed which extend, chiefly at an angle from the protective strip, into the field. These tongues and projections of the snow drifts are often harmful, blocking roads, and delaying tillage of the soil until late in the spring. Sometimes this leads to injury of winter grain by mold.

Should the blizzards come from several directions the drifts of the snow will pile up from many sides. A junction of the drifts may occur within the strip. In such cases a solid unbroken drift will be formed, with the usual tails and tongues. The further the snow drift lies from the strip the thinner it is. From the windward side the train, A, diminishes rather rapidly, whereas from the leeward side, E, it diminishes much more gradually.

The Water Reserves

At some distance from the belt the water reserve of the snow cover falls below "normal." I consider that reserve as "normal" which is characteristic of the snow blanket unexposed either to depletion or to enrichment by the wind and is formed entirely by the local snow fall. Such normal snow cover is found on small forest meadows or openings; a similar snow cover is also found in deciduous forests which do not retain much snow on their crowns but which are nevertheless some distance from fields and other open spaces from which the high blizzards could be blown in.

Beyond the line of "normal" snow cover stretches an area from which the snow is blown off, and its water reserve, therefore, falls below normal. This portion of the field, likewise, has a decreasing supply of water depending on its distance from the shelter belt. The limits for such decrease of water may be lower than the average water reserve of an entirely open field. In such a case the belt also has a negative influence on soil moisture supply in the immediately adjacent field.

The distribution of the zones of the various conditions of snow cover is shown in Figure 2. The letters here are the same as in Figure 1, including, in addition: F, the limit of normal water reserve of the snow cover; G, the limit of water reserve of the blanket of the open steppe (=0); (—), below this reserve; (±) equal to, or in spots, lower or higher; (+), water reserve greater than in the open steppe and (#), the main mass of the snow drift.

In spring, during the melting of the snow, a corresponding moistening of the soil takes place. Under the drifts the soil often thaws out before the blanket melts, and therefore is more easily permeable to the water. Therefore, the water of the snow drifts, for the most part, is wholly absorbed by the soil, while in other parts a large portion of the water runs off on the soil surface. Thus, in spring, the driest and least water-saturated soil appears in areas G-G, (least in the open steppe, G, next least in zones G-F, F-E, E, D, A, B, and C). The greatest part of the drift is absorbed by the strip itself. It is this that produces the moisture that enables the strips of forest to grow better than they would under the same conditions in the case of

large forest tracts. But this increase is gained at the expense of portions G-G, and in part, G-F.

From Figure 2 we see, if we should bring the strips closer together, first of all that the zones G-G will diminish and next the zones G-F. When this latter zone has vanished, the snow will no longer be blown off from between the strips, and the field will be entirely shielded. In the intermediate strips of the prairie, however, no additional snow will gather, but only a normal cover as in the case of a large forest tract.

Width of Strips and Extent of Influence

It is difficult to give the average widths of the zones of influence of the shelter belts for they depend on many changeable conditions, such as climate, weather, topography, species, density and height of the planted trees, their position with respect to the direction of the wind, etc. Approximately we may assume that if the height of a fairly dense plantation is H, the distance from the leeward forest strip boundary to the line F will be 10H, while the distance to G will equal from 20H to 25H. According to Piatnitsky's formula, it is equal to 2.5H.[2] For instance, in case the height of an established plantation is 10-12 meters, the zone thus created would equal approximately 250 meters.

The role played by cross strips in a general network has been little studied. Usually such strips are planted at greater distances and they are narrower.

The width of the strips, in my opinion, must correspond to fairly good conditions for growth, in order to grow valuable timber products and accumulate snow drifts. To protect extensive areas with windbreaks the first windward strip of the area to be protected must be not less than from 50 to 60 meters in width; and other strips in a sparse network, not less than 20 meters; and in a dense network, not less than 10 meters. However, such standards for the most part are not adhered to.

Some silviculturists consider it better to create strip plantations of sparsely planted trees which intercept little snow but permit it to be carried on through to be deposited in very flat and wide layers of additional drifts beyond the plantations and along the leeward side in the zone of the weakened air stream. We have as yet been unable to create such plantations and have them remain stable and give useful results. They branch out greatly, die out, and, due to the absence of underbrush, the soil becomes soddy and weeds develop excessively. Perhaps it would be possible to replace them with narrow, low hedges, consisting, for example, of *Eleagnus angustifolia, Gleditsia,* or *Maclura* with short rotations of felling or trimming. All this refers to the condition of a plain. Topography adds various complications. On the windward slopes, the width of the various near-strip zones, A, E, and F, are diminished on account of

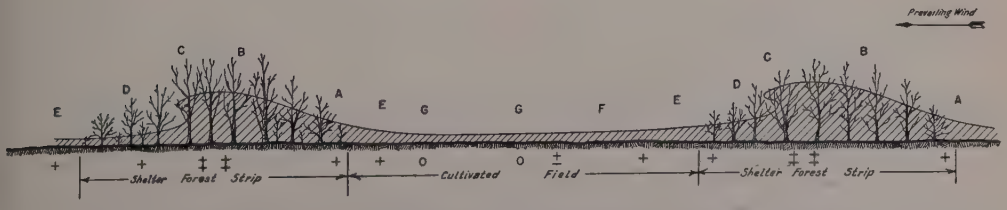

Fig. 2.—Distribution of snow within and between shelter belts and of water reserves.

the widening of the wind swept zones, G-G. The leeward slopes, however, should be widened. On hilly surfaces the snow cover is distributed very unevenly. On such terrain the shelter strips should be arranged accordingly. Locating protective strips above valleys, above ravines, and along the upper portions of steep inclines, is all very beneficial. They help to hold back the snow, to diminish the surface run-off of the melted snow, and to increase the soil moisture on the higher places and the slopes.

Influence on Aeolian Erosion

It is self evident that forest strips are also beneficial in wind erosion control. It is beneficial to plant such sand-protective and sand-absorbing strips within and along the edges of regions of moving sand dunes. If the sand has covered the cultivated soil with a thin layer, we can, in some cases, effect the removal of the blown sand into forest strips by planting (in regions of strong dry winds) strips at right angles to the wind at sufficient distances one from the other. The loose condition of the sand for removal by wind may be retained by driving cattle over the interstrip areas. Small mounds of sand will be formed and at intervals the soil will become exposed and may again be returned to cultivation.[3]

Crop Production on Protected Fields

Crop production of a field depends, first of all, on the agricultural technique. Only with good technique can the influence of the protection be fully realized. In general, crop production of various zones in proximity to the forest strips depends on the moisture which is distributed in proportion to the snow cover and the prevailing winds. Only in the immediate proximity of the strip is noticed the ill effect caused by shading, drying because of the roots of the strip trees, delayed thawing, and especially by the difficulty of proper cultivation of the soil to keep out weeds. The width of the zone of decreased yield is not very great, varying from 5 to 15 meters. Its most harmful influence is manifested on late crops, especially root crops and grains.

Beyond the strip of decreased yield is the zone of optimum production. At a certain distance it reaches its maximum (in mass) and optimum (in quality, as for example, grains and potatoes) which is followed by a general diminution toward the center of the greatest wind activity (most fully wind swept), G-G, Figure 2. Here the harvest approximates that in the open steppe and is sometimes even below the latter.

Thus are the harvests distributed in the protected areas. Their general relation to the harvest under similar topographic and cultural conditions of the open steppe is determined by the mutual correlations between the various zones of proximity to the forest strips. In general, however, the zone of positive influence seems to have the advantage, and the average crop gains because of the protection. However, the results are subject to many variations. In case of a winter of but little snow and much sleet and also in the case of strong dry spring winds blowing out the loose soil and the seedlings (the so-called "black storms"), the protection of fields by forest strips can be extremely effective and useful.

At times too great a stagnation of the air provokes extreme temperatures which are harmful from the standpoint of frosts

[3]See author's "Ouchenie o lesnoi pertinentzii" 1930, p. 30-34.

and from the standpoint of overheating and burning, especially during flowering.

Forest Products

The prairie plantations have, in my opinion, great significance as a source of valuable wood material, especially on the more favorable growing sites. It is time to stop the use for fuel of dried cow dung and straw; these should be returned to the soil to maintain its fertility, even in the black earth areas. Instead of them we should use the small thinnings and the limb wood, while the larger material should be used for other farm needs, e. g., stakes, posts, beams, etc. This should prompt us to try to grow valuable timber in the larger and more compact stands and to organize correct rotations for cuttings and regeneration.

Other Forms of Protection

So far in this paper I have dealt with the influence of forests and forest strips upon the Steppes. But besides these, in the prairie region some other protective plantings are used which can not be considered as forest plantings proper. Such are hedges and narrow plantings of trees in one, two, or three rows. Narrow strip planting comprises a transition from single tree plantings to forest planting. Strips, 10 meters or less in width, and hedges can be of some use for field protection. These strips, especially when composed of tall species, such as birch and cottonwood not densely planted, are easily penetrated by wind. They have no shrubby understory and they possess certain peculiarities that make them beneficial as far as field protection and influence on the microclimate are concerned. Judging from descriptions and photographs in C. G. Bates' publication, such windbreaks are quite common in the United States and are more often employed than forest groves. In the U.S.S.R. similar windbreaks are used and in certain instances they proved to be more useful than broad forest belts where typical forest conditions would be created.

The narrow, tall windbreaks are suitable for the relatively more humid transition zone between forests and prairies where birch and cottonwood survive better than in the dry soils of the southern steppes. Even in the case of such windbreaks a certain accumulation of snow takes place on the windward side of the strip, but within the strip, the velocity of the streams of broken air current might increase; accordingly, accumulation is either very negligible or even negative, since blowing out might occur. On the leeward side, the broken streams of air collide, creating a loss of wind velocity and causing more uniform and more extensive settling of the snow. The result is a broader "mantle" of snow than in the above mentioned leeward "tail," D-E-F, Figure 2. The air currents are mixed together and the negative zone G-G, Figure 2, is usually absent for a distance of about one kilometer (⅝ mile). Moreover, the microclimatic elements are not differentiated here to the extent which takes place in the case of dense forest strips. Fluctuations of day and night temperatures and relative humidity are smaller in comparison with an unprotected steppe. Danger of frost and sun scald damage is also lessened.

Unfortunately, we have not learned yet how to grow such tall, narrow and open windbreaks in the drier regions of our Steppes, although in some instances, the American *Gleditsia* planted in 2 or 3 rows has been successfully used. Of course, the honey locust windbreaks invite weed invasion and sodding. Usually, in 10 to 30 years such windbreaks start to dry out. Then, they are cut down, the soil between the rows is well plowed, and the locust produces good, fast-growing sprouts. Soon a light canopy wind-

break is formed. In extreme cases of dryness and alkalinity of the soil, similar windbreaks may be composed of *Eleagnus angustifolia* or perhaps in warmer climate, Mesquite (*Prosopis juliflora*) could be used.

It is not impossible that under conditions of extreme drought, an artificial light lattic screen attached to posts could be used to advantage. Of course, measures like this are beyond the purview of foresters.

Shelterbelt Problems Are Complex

It is evident from the above that (prairie) silviculture presents some very complex problems which are quite different in various regions and under different natural and economic conditions. To organize properly the forest culture in the steppes and plot out the strips with regard to the more harmful winds in connection with the topography and the soil, and to manage the forest correctly, is an art which requires good knowledge of ecology and economical aspects of agriculture as well as a broad minded approach free from routine methods and from preconceived ideas.

Ed. Note.—The mention of Zon on page 781 made it necessary to bring to his attention the paragraph in which his name appears. In a personal letter to the Editor-in-Chief he expresses surprise that a question of failure on his part to give suitable recognition of indebtedness to the author of the preceding article should arise at this time, but prefers not to enter into controversy regarding the matter. For clarification, a portion of his letter is quoted:

"Questions of credit . . . lead to odious quarrels . . . Vyssotsky may have some justifiable grievance for not receiving more specific credit in my article which appeared in *Science* in 1913. . . . In several subsequent publications I mentioned his name more specifically. . . . My article, after it appeared . . . was sent to the Russian *Journal of Forestry*, and a personal copy to Vyssotsky.—Vyssotsky himself, writing in the Russian *Journal of Forestry* in 1913, and again in a . . . pamphlet on Hydro Forest Essays in 1924, referred to it . . . without a trace of bitterness or complaint. . . ."

THE NATIONAL PROBLEM OF FOREST OWNERSHIP

By JOHN B. WOODS[1] and FRANKLIN REED[2]

IN Colonial time, and for nearly a century thereafter, private ownership was considered to be the sole medium through which land and its resources could be properly developed and used. Government as a land-owner was held to possess only one function, namely, to pass the land to private title as rapidly as takers could be found.

It was not until 1872, when Congress created the Yellowstone National Park, that the policy of permanent public ownership of large land areas of any sort first took definite form. Not until 1885 did public opinion begin definitely to support the idea that permanent ownership of forest lands was a proper government function. New York State established its Adirondack Preserve in that year. Pennsylvania initiated its state forest system some years later. The Federal Congress in 1891, when it repealed the Timber Culture Act, authorized the President to set aside "forest reserves" from the unreserved public domain. Thus, began deliberate federal forest landlordship.

During the next twenty years the western National Forest system was created, by reservation from the public domain. Public support of permanent government forest ownership broadened and culminated in 1911 in the enactment of the Weeks law which authorized the federal government to acquire by purchase lands on the headwaters of navigable streams for watershed protection. At that time it was believed to be unconstitutional for the federal government to purchase and own lands for strictly timber production purposes, but that inhibition was ignored twelve years later when the Congress enacted the Clarke-McNary law which extended the federal authority to the purchase of lands for timber production purposes providing they should be in the watersheds of navigable streams. The question of constitutionality has not yet been raised and answered.

Meanwhile the original thirteen states had long since disposed of all their public lands, and most of the earlier public land states through the agency of the federal government had done likewise. Even in the states of the far west large forest areas had passed to private title.

Consequently, as the concept of public forest ownership has grown, pressure has increased for continually larger expenditures by federal and state governments for the repurchase of forest lands. What the proper ultimate limits of public forest ownership may be is a question which has not yet been answered definitely or acceptably to all who are interested. We have such official pronouncements as the Copeland Report and the more recent report of the National Resources Board, both admirable efforts to answer this and other questions of very grave import, but we have no convincing evidence that the conclusions reached in either are accepted by a majority of interested and informed citizens.

There are, as in all matters of broad public interest, several definite schools of thought upon the place of public ownership in the forestry scheme. At one extreme is the group which believes complete public ownership is the only answer; that private ownership is irretrievably down, out, and hopeless. Some of this group would have complete

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[1]Director of Conservation, National Lumber Mfrs. Assn.
[2]Executive Secretary, Society of American Foresters.

nationalization; they place as little faith in the several states as in private owners. Others would give to the states the major task and relegate federal participation to a position of minor importance.

One may still find intelligent and undismayed citizens who advocate entire private ownership, believing that enlightened self-interest is the strongest incentive to sustained forest production.

Between these extremes are many shadings of opinion. Most human results are compromises. Certainly there in place for the expression of intermediate views in this present discussion.

Attempts to draw the line between public and private responsibility or to define specifically those classes of forest land which should be privately owned or in public ownership for the common good undoubtedly will disclose differences of opinion infinitely varied. So much the better! It is time for such opinions to be brought out. In formulation of forest acquisition policy expression must be given to all reasonable viewpoints of those who can show legitimate interest.

The delineation of an ideal ownership set-up necessarily will be affected by the facts of ownership as it exists today. For example, one may assert that county ownership of forest lands generally is undesirable because of the difficulties of financing administration and protection, but it is a fact that already many counties do own such lands; most of it reverted to them on account of tax delinquency.

Advocates of nationalization of all forest lands must face the problem of financing such tremendous acquisitions. Even such a project as that recommended by the National Resources Board calls for the investment of several hundred millions of dollars. Where is the money to come from and over how long a period is it to be expended? Is it not possible to reduce the demand upon the public purse by making use of the public borrowing power along the lines laid down by the Farm Credit Act to make available loans to private owners for the purpose of sustained timber production? It is held by some that the granting of such loans under proper guarantees would accomplish far more than the outright expenditure of similar sums for public purchases of forest areas.

There is a school of thought which holds that public acquisition should begin at the opposite end of the scale from private ownership, that purchases should be limited at first to those classes of forest land which, having public importance for wateshed protection or recreation, are impossible of profitable management by private owners. Such belief may be based upon a narrow concept of the functions of government, or it may spring from an acknowledgment of the present relation between timber supply and demand, indicating no shortage but rather a growing surplus and pointing toward the advisability of limiting intensive silviculture to the most fertile soils and most favored localities.

Some of the advocates of nationalization are members of the forest-using industries. Most of the arguments advanced by this particular class of supporters have followed such lines as would indicate selfish desire to unload rather than any determination to help solve a national problem. However, there un doubtedly are industry advocates of large public ownership whose motives are above suspicion and whose clarity of thought might contribute to this discussion. They should be heard from. Undoubtedly it would be most helpful to the Society's Committee on Public Forest Acquisition Policy in its effort to formulate a statement of policy for consideration by the profession if all who have thought upon these things would present their views for publication in the JOURNAL.

If a virtual monopoly by the federal government of the forest resources is the proper solution of our national forest problem, no time nor set of circumstances could be more propitious than the present. Federal money has been made available to finance an infiinite variety of new schemes for economic and social betterment. At least three federal agencies are now engaged in the purchase of lands upon which forests might well be grown. Before the most recent relief appropriation, running to nearly five billion dollars, has been expended we may face the fact of federal ownership having been so far advanced as to make impossible the carrying out by private owners of any considerable portion of the forest growing task.

If, on the other hand, private forest ownership on a broad scale has its place in the sun and can carry on, given adequate public aid and cooperation, the present is likewise the crucial time for decision and action.

Possibly an analogy can be found across the seas. Germany is commonly recognized as the country where forestry orginated and where the greatest progress has been made. During the period of progress Germany had no federal forest service and no national forest system. Each state had its own system of state forests and maintained its own independent state forest service. Alongside of them were the counterpart of our American timber barons, the great landed aristocracy, who maintained their own staffs of professional foresters to manage their forest properties. In turn each German forest school was an independent unit for education and research. Among these several independent groups was professional rivalry and competition, free interchange of professional thought and opinion, and continual progress in forestry in all its several fields. In France on the other hand, with its highly centralized form of government, the federal forest service has dominated the whole situation, even to the thoughts and opinion of those members of the profession in private employ. In America, which do we need the most? A highly centralized system of federal ownership and control, or a decentralized scheme of things? Both have their advantages and their shortcomings, but we cannot have both. Perhaps we are at the parting of the ways where we American "foresters must choose."

Annual Meeting Committees

Committee on Arrangements, J. C. Kircher, *Chairman;* Committee on Program, H. H. Chapman, *Chairman,* G. D. Marckworth, Carlile P. Winslow, Verne Rhoades, Clarence Korstian.

SUMMARY OF FOREST PRACTICE RULES UNDER THE CONSERVATION CODE (ARTICLE X)

By A. B. RECKNAGEL

ALTHOUGH the "Lumber Code" (so-called) is now defunct, extraordinary interest attaches to the Forest Practice Rules which were promulgated under the Conservation Code (i. e. Schedule C of the Lumber Code) approved by President Roosevelt on March 23, 1934. In order to preserve these rules, the present summary has been prepared omitting, however, the mention of any administrative agency. The "National," and some of the regional lumber manufacturers' associations, are going ahead with the conservation work despite the cessation of the N.R.A. and its codes. The National Lumber Manufacturers' Association, through its Executive Committee, has reappointed the five industry members of the Joint Committee of the National Forest Conservation Conference, held in Washington, D. C. October, 1933 and January, 1934. (See the JOURNAL OF FORESTRY for March, 1934). Whatever progress is made along lines of private forestry in the future will undoubtedly stem from these forest practice rules which, although simple, are sound and have proved workable.

SUMMARY OF CONSERVATION CODE[1]

Section 1.—Each division and each subdivision having jurisdiction over forest utilization operations shall establish or designate an agency or agencies to formulate and from time to time to revise rules of forest practice, and to exercise general supervision over the application and enforcement thereof in the operations of the persons of the respective divisions and subdivisions. Such agencies shall have as non-voting, advisory members one representative of each of the state and federal organizations which have definite responsibility under state and federal laws for forestry or forest protection practice within the several divisions and subdivisions. Each division and each subdivision shall provide such technical and other qualified personnel as may be required to furnish necessary information to said agencies and persons, to inspect the forest operations of said persons, to enforce such rules of forest practice, and otherwise to carry out the purposes of this Schedule. Each such agency shall formulate such rules of forest practice, and shall submit them through the appropriate channels to the Authority for its approval. Which approved forest practice rules on and after June 1, 1934, shall be obligatory for all persons subject to the jurisdiction of the said division and subdivisions.

Section 2.—Said rules of forest practice, to insure the conservation and sustained production of forest resources, shall include practicable measures to be taken by the operators to safeguard timber and young growing stock from injury by fire and other destructive forces, to prevent damage to young trees during logging operations, to provide for restocking the land after logging if sufficient advance growth is not already present, and where feasible, to leave some portion of merchantable timber (usually the less mature trees) as a basis for growth and the next timber crop. Said rules of forest practice shall be adequate to secure the purposes of this Schedule, and in a practical way in accordance

[1]Schedule C—Forest Conservation Code approved by President Roosevelt March 23, 1934. Lumber Code Authority Bull. 95, 1934. Washington, D. C.

with conditions existing in the respective divisions and subdivisions shall secure applications of the following principles:

(a) Fire protection during and immediately following logging is an indispensable condition for forest regrowth. Responsibility for adequate provision for control of fires during or immediately following logging operations rests upon the individual operator, if he is in any way the cause of such fires. Each operator shall be definitely responsible for taking practical measures of fire control. Such measures shall, to the extent necessary to provide adequate protection, include slash and snag disposal, rules as to use of fire by employees, including smoking in the woods, equipment of logging locomotives and engines with adequate devices for preventing fires, having available upon call crews properly equipped to fight fires, closing operations during exceptionally dry periods, and other precautionary measures.

(b) To the end that protection against fire and other destructive forces may be rapidly extended to all forest areas that require protection, said agencies shall endeavor to secure action on the part of all operating forest and land owners in the direction of cooperating with public organizations, in systematic fire prevention and suppression, and such protective action as may be practicable for protection against insects and diseases. Such agencies shall also seek to secure such cooperation on the part of non-operating forest land owners.

(c) As much as practicable of the advance growing stock upon the land in the form of young trees of valuable species below merchantable size shall be preserved during logging operations, and left without injury for future growth. Each operator shall require his woods employees to exercise conscious care to reduce damage to advance growth to the minimum practicable.

(d) To secure natural reproduction, which will usually be obtained where partial cutting is practiced, there shall be left on the logged areas, where economic and other conditions permit, a sufficient number of trees of desirable species to yield a commercial cut at reasonable intervals. Under certain conditions, instead of partial cutting, the leaving of seed trees or groups of seed trees on or adjacent to logged areas may be sufficient to insure the required regrowth on the logged areas. If there is an insufficient reserve stand, or if conditions are otherwise adverse and the prospects of securing natural reseeding are uncertain, planting may be desirable.

(e) To the extent practicable, partial cutting or selective logging shall be the general standard for local measures of forest practice. In certain regions or forest types, and under certain conditions which do not justify partial cutting or selective logging, other methods shall be allowed.

(f) In order to provide flexibility, each operator shall be encouraged to communicate to his agency the methods which he proposes as best suited in his individual operation to achieve the declared objectives of conservation and sustained production of forest resources, and if such proposed methods are determined by said agency to equal or excel the regional or type standard methods, they shall be approved in lieu thereof. This in effect permits modification of regional or type standards upon submission and approval of specific individual management plans.

(g) Said agencies shall, each within its own jurisdiction, investigate the feasibility of, and shall actively encourage the application of, sustained yield forest management wherever feasible. Article VIII, K, of the Code was amended at the same time, granting a 10 per cent increase in production quotas to operators certified as being on a basis of sustained yield.

Summary of the Forest Practice Rules

1. The West Coast Douglas Fir[2]

Forest Protection during and immediately following logging aims to reduce, if possible, to one per cent or less the annual loss in cut-over areas burned by forest fires, through observance of the state forest fire codes and certain prescribed supplementary measures.

Conservation of Immature Trees and Young Growth.—Trees to be reserved from cutting are to be protected against damage by logging equipment and from falling and unnecessary swamping.

Provisions for Restocking the Land after Cutting.—There shall be adequate provision for reseeding the cut-over area either from adjacent uncut areas or by the leaving of groups of seed trees. No areas clear cut shall be more than approximately ¼ mile from reserved timber "of such amount that it may reasonably be expected to furnish an adequate source of seed."

Where financially advanageous, planting or direct seeding may be substituted. Two features of the West Coast rules are worthy of mention as being revolutionary in concept and application. First, the bestowal of authority upon the Code Agency to close operations during periods of extreme fire hazard; second, the requirement to cut all snags.

2. The Ponderosa Pine (Western Yellow Pine)[3]

Forest Protection.—The state forest fire codes will be observed together with supplementary measures including slash disposal, spark arresters, and systematic organization for fire prevention as described in U. S. Department Agric. Tech. Bull. 259. Revolutionary is the principle that slash disposal shall be so handled as to secure destruction of the maximum volume of slash with the minimum damage to the soil and reproduction.

Conservation of Immature Trees and Young Growth.—Seven specific rules apply to all districts:

1. Carefully locate the roads and main skidding tracts.
2. Restrict clearing for landing sites to the minimum.
3. Limit width of main skidding trails and roads.
4. Fall trees in line with direction to be skidded.
5. Fall trees away from clumps of young growth.
6. Confine drivers to main skidding and back trip trails.
7. Forbid indiscriminate and unnecessary swamping.

Provisions for Restocking the Land after Cutting.—These place emphasis on partial cutting or selective logging and provide specifically as follows:

A. *Ponderosa Pine Type.* (Mont., Ida., Wash., Ore.).—No operator shall cut western yellow pine 14 inches d.b.h. or less.[4] No size limitation on other species. Where advance growth is lacking, the operator is required to leave scattered over the area the following number of full crowned pines per acre:

4 trees 16 or 17 inches d.b.h. *or*
3 trees 18, 19 or 20 inches d.b.h. *or*
2 trees over 20 inches d.b.h.

B. *Larch-Douglas Fir Type.*—No operator shall cut western yellow pine 14 inches d.b.h. or less, nor other trees, except white pine, 13 inches d.b.h. or less. This applies only to lumber.

C. *White Pine Type.*—The operator shall leave as a minimum, on the average

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[2]Lumber Code Authority Bull. 119, 1934. Washington, D. C.
[3]Lumber Code Authority Bull. 123, 1934. Washington, D. C. Revised Dec. 10, 1934.
[4]This provision is 13 inches in the Idaho District.

acre, well distributed white pine trees as follows:

6 trees 12 inches d.b.h. and over, *or*
4 trees 14 inches d.b.h. and over, *or*
2 trees 16 inches d.b.h. and over,

except on areas well stocked with young growth of white pine or in the case of very old and overmature stands where white pine may be cut clean.

D. *California Pine Region* (East side).—No sound ponderosa or sugar pines 16 inches d.b.h. and under shall be cut. West side).—No pine trees 22 inches d.b.h. and under shall be cut. The California Pine Forest Practice Committee may require that seed trees be left.

E. *Arizona and New Mexico Pine Region.*—In sawtimber only: leave all trees below 12 inches d.b.h. and not less than 2 seed trees per acre or leave not less than 10 per cent of the gross volume per acre. Seed trees must be 17 inches d.b.h. or over, wind-firm, well-crowned. White fir is not a satisfactory seed tree.

In sawtimber combined with mine timber and railroad ties: leave all trees below 8 inches d. b. h. and not less than 4 seed trees per acre, except that in thickets trees may be taken to 6 inches d.b.h. Seed trees as defined above.

F. *Rocky Mountain Region.*—In Utah and Nevada cut no western yellow pines under 16 inches d.b.h. Where advance growth lacking, 4 additional seed trees 16 inches d.b.h. and larger to be left per acre. Elsewhere, where clear cutting threatens, leave at least 5 trees 10 inches d.b.h. and larger per acre. In Engelmann spruce leave 20 per cent of the volume of the stand. In lodgepole pine type, selective cutting is desirable but no limitation on the degree of cutting is necessary.

3. CALIFORNIA REDWOOD[5]

Forest Protection.—Operators shall use due diligence; fire fighting tools sufficient to equip ⅓ of logging camp personnel; logging slash may be burned once before log removal, once within year thereafter. All cutover lands, within operating area, shall be protected from fire on scale to hold average acreage burned to 1 per cent per year, or less.

Conservation of Immature Trees and Young Growth.—"The density of redwood timber stands, immense size of the logs and enormous amount of slashing debris do not permit . . . the leaving of much young growth uninjured at the time of logging."

Provisions for Restocking the Land after Cutting.—To insure restocking after cutting and to supplement the stump sprouts of redwood, there shall be left not less than 4 conifers, 20 inches or more d.b.h., as seed trees, per acre. Where this is impracticable (because of slackline logging) seeding or planting shall be required. Operators are to be "conscientiously experimenting to determine methods that will provide for the reseeding." Because of maturity and density of stands, partial cuttining or selective logging is not generally applicable. The principle of sustained yield is approved as a desirable objective.

4. SOUTHERN PINE[6]

Fire protection.—Owner or operator designates a competent fire chief, installs and maintains on logging locomotives and logging and sawmill equipment adequate devices for prevention; disposes of slash as prescribed by the Southern Pine Association.

Conservation of Immature Trees and Young Growth.—No avoidable damage;

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[5]Lumber Code Authority Bull. 124, 1934. Washington, D. C.
[6]Lumber Code Authority Bull. 118, 1934. Washington, D. C. Revised Oct. 31, 1934.

logging and skid roads held to minimum number and width, no waste of good material in logging.

Provisions for Restocking the Land after Cutting.—Operators shall leave following number of trees per acre:

100 trees of 4 to 7 inches diam. on stump one foot high *or* 10 trees of 8 to 11 inch diam. on stump one foot high *or* 2 trees of 12 inches diam. on stump one foot high and up. (If pure longleaf pine, 4 trees 12 inches and up). The amendment of October, 1934, permitted thrifty longleaf pines 5 feet or more in height to be counted as equivalent to 4 inch trees of other species. This average is to be for the ten acre blocks. Any combinations of the above groupings are permissible. Hardwoods (not defective or of undesirable species) are included with softwoods in types containing hardwoods.

5. APPALACHIAN AND SOUTHERN HARDWOODS[7]

Forest Protection.—Each owner or operator shall designate a competent man. Dangerous slash and logging and milling debris shall be disposed of as District Committees direct by "specific rules set up by each District Forest Practice Committee."

Conservation of Immature Trees and Young Growth.—"Advance young growth to be saved. Cutting of young growth or immature trees to be held to the minimum except for purposes of improving spacing, quality, composition, conditions favorable to utilization or to utilize trees of poor form."

Provisions for Restocking the Land after Cutting.—Operators shall leave, uncut and undamaged, per acre (for five acre averages) the following well-distributed, thrifty trees of desirable species (including softwoods in mixed types):

100 trees 2 to 9 inches d.b.h. *or*
25 trees 10 to 12 inches d.b.h. *or* failing these, then
4 trees over 11 inches d.b.h.

6. SOUTHERN CYPRESS[8]

Forest Protection.—Standard "blanket" provisions. "No slash or brush disposal will be required in the swamps."

Conservation of Immature Trees and Young Growth.—"No changes in the usual logging methods are required."

Provisions for Restocking Land after Cutting.—"From the very nature of the growth of Tidewater red cypress in the swamps and the limit of its utilization by the operator, many seed trees and groups of seed trees are left on and adjacent to the logged areas. These, together with the stands of smaller cypress and associated species, surrounding the strands and pockets which are logged, shall be left untouched in condition for continued growth and for restocking the land."

Sustained yield is inapplicable in pure stands of Tidewater red cypress. The Committee on Forest Conservation will determine the extent to which sustained yield is applicable in intermingled (cypress-hardwood-pine) stands "over appropriate economic units."

7. NORTHERN PINE[9]

Forest Protection, "is essential and constitutes the first objective under any plan of continuous forest production in Minnesota," To secure it, operators shall designate "a competent man . . . responsible for fire protection activities," shall furnish and maintain sufficient fire fighting tools to equip at least 50 per cent of the men of logging operations, shall

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[7]Lumber Code Authority Bull. 122, 1934. Washington, D. C.
[8]Lumber Code Authority Bull. 121, 1934. Washington, D. C.
[9]Lumber Code Authority Bull. 117, 1934. Washington, D. C.

equip all locomotives, sawmill and logging engines with adequate devices for preventing and suppressing fires and shall dispose of slash in a manner and at a time to afford adequate protection.

Conservation of Immature Trees and Young Growth.—"All trees having future prospective value, but which, by reason of species, character, market condition or inaccessibility would be unprofitable . . . if cut should be preserved." The customary provisions regarding logging roads and skidways and use of inferior species in construction, follow.

Provisions for Restocking the Land after Cutting — For the pine-hardwood type: Clear cutting is permissible if abundant young growth is present of desirable species or if not less than 4 seed trees 12 inches d.b.h. and up are left per acre.

For the mixed swamp-conifer type: No spruce or cedar under 5 inches d.b.h or tamarack under 4 inches d.b.h. to be cut.

For Jack pine type: As in the pine-hardwood type, if seed trees are left there must be not less than 4 trees (of desirable species) as least 8 inches d.b.h.

8. THE NORTHERN HEMLOCK AND HARDWOODS[10]

Forest Protection.—Provides for disposal by the operator of all slash up to 4 inches in diameter along roads, railroads and abutting property lines. Within such strips all dead snags or stubs more than 15 feet high shall be felled. Each owner or operator shall designate a competent firemen for his operation. All logging engines and sawmill engines shall be adequately equipped for preventing the starting of fires. Equipment for extinguishing fires is required.

Conservation of Immature Trees and Young Growth. — Specific instructions shall be prepared for each logging operation to preserve all desirable seedlings and saplings of valuable species. The cutting of young growth or immature trees is to be held to the minimum.

Provisions for Restocking the Land after Cutting.—For the hardwood and hemlock: Either partial cutting (selective logging) which leaves 1/3 of the merchantable volume uncut, *or* leaving all trees except hemlock and other softwoods, 10 inches d.b.h. and under; *or* leaving as seed trees per average acre, the following numbers of trees by size classes, or any proportional combination thereof: 100 of d.b.h. 1 to 7 inches; 25 of d.b.h. 8 to 12 inches; and 5 of d.b.h. 13 to 18 inches. Defective hardwoods and trees of undesirable species shall not be counted.

Sustained yield, recognized as a basic objective, is held impractical at present on a region-wide basis.

9. NORTH CENTRAL HARDWOODS[11]

Forest Protection.—General "blanket" provisions.

Conservation of Immature Trees and Young Growth.—General "blanket" provisions as in Conservation Code.

Provisions for Restocking the Land after Cutting.—The following numbers of trees by size classes, or any proportional combination thereof, shall be left, in selective logging or as seed trees (in clear cutting), or any proportional combination thereof, as a minimum per acre:

100 trees 3 to 7 inches d.b.h. *or*
25 trees 8 to 12 inches d.b.h. *or*
5 trees 13 to 18 inches d.b.h.

Defective hardwoods and trees of undesirable species shall not be counted.

"Selective cutting is a measure that leads directly and logically towards sustained yield. The principles of selective

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[10]Lumber Code Authority Bull. 125, 1934. Washington, D. C. Revised Oct. 31, 1934.
[11]Lumber Code Authority Bull. 120, 1934. Washington, D. C.

cutting and sustained yield operations shall be incorporated in the management plans of individual operators."

10. NORTHEASTERN SOFTWOODS AND HARDWOODS[12]

Forest Protection.—These rules (and all that follow) are skeleton outlines of general requirements, since each local committee "shall formulate and enforce a set of regulations governing woods practice within its jurisdiction." This is the Swedish system in operation and is necessary for effective local application of the requirements. There were to be local committees for each state or group of states, the chairmen to constitute the division committee.

Conservation of Immature Trees and Young Growth.—"Except as unavoidable in logging, immature trees shall not be cut for any purpose except to improve the forest in spacing, quality, composition, or condition for restocking."

Provisions for Restocking Land after Cutting.—Contains one new provision: "Where grazing would prevent restocking or destroy desirable advance growth, it shall be restricted." Individual management plans (in a form prescribed by the division committee) are emphasized, as is sustained yield whereby "the average amount of timber cut in any five year period should not exceed current growth of the major forest regions under the jurisdiction of any local committee."

11. ADDENDA

Clearing for Other Uses.—All the rules include Article (IX) "Clearing for other uses" which provide for special permission before clearing any land in excess of five (5) acres in size. In other words, all land cut over by any person under the Code was subject to the application of the Forest Practice Rules, unless specifically exempted.

Slash Disposal.—The western pine rules recognize the principle that slash disposal should be so handled as to secure destruction of the maximum volume of slash with the minimum damage to the soil and reproduction. A limit was placed upon the amount of ground surface that fire should be allowed to run over and considerable latitude was allowed as to method of treatment, the purpose being, of course, to destroy the most slash upon the smallest possible area. The felling of snags was prescribed in the West Coast Division.

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[12]Lumber Code Authority Bull. 126, 1934. Washington, D. C.

A SIMPLIFIED INCREMENT DETERMINATION ON THE BASIS OF STAND TABLES

By H. ARTHUR MEYER[1]

One of the most important problems of economic forestry is the determination of the mean annual or periodic growth of stands and forests. A simple, cheap, and relatively accurate method of determining the periodic growth of the forest is described in this paper. Known as the "méthode du contrôle," it is being applied in Switzerland and in certain parts of France, and has recently been introduced in Prussia. It is here presented for consideration with reference to its possible usefulness both in research and in silvicultural practice in the United States.

IN 1890 the Swiss forester H. E. Biolley began to make continuous inventories and to calculate the periodic growth of some of the communal forests in Neuchâtel Canton, using the ideas of the French forester H. Gurnaud, who first proposed the "méthode du contrôle" in 1878 at the Universal Exposition in Paris (2). Biolley later introduced the method upon the public forests of the whole Canton (1). French foresters have further improved and developed the method (3). It is especially suited to mixed and uneven-aged stands and to increment studies of large areas. From the same field work the volume increment, basal area increment, and the average diameter increment for every diameter class can be calculated.

Field Methods

The field work obtains the basis for the necessary stand tables. The trees are classified according to their diameter breast high. The classification can be made at the time of taking the measurements. Usually only trees above a fixed diameter limit are measured. After a certain period the trees are remeasured. The diameter of all cut and dead trees must be obtained before their removal. This very essential characteristic of the method of control is called the "standing control of the products" (stehende Nutzungskontrolle). The cut trees may be measured when marked or just before felling.

In this way are obtained: (1) Stand table of the first inventory; (2) stand table of the second inventory; and (3) stand table of the removed trees (including dead trees.) It is obvious that any kind of increment—volume, basal area, or diameter—consists of the difference $[(2)+(3)]-(1)$.[2]

Accurate calculation of the periodic increment necessitates measurements all made in exactly the same way. The following method is simple, cheap, and accurate. The men work in groups of three. Two caliper the diameter breast high of every tree above the diameter limit, calling out, usually in turn, the class to which the tree belongs. Trees are measured only once and from the same direction, which in the case of a slope is the uphill side. The point of measurement is marked by scribing a 2- to 3-inch mark on the bark. If the trees are all marked on the same side, the recorder coming behind easily spots any that have been missed. When a tree is removed before the second inventory is made, the diameter of each tree is taken exactly at the same spot where first measured and the old mark renewed in the

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[1]Collaborator 1934-35, Section of Forest Measurements, U. S. Forest Service; formerly Assistant in Forestry at the Eidgenössische Technische Hochschule, Zurich, Switzerland.

[2]In the United States this is usually called *gross increment*, to distinguish it from *net increment*, which is (2)—(1). In Europe the latter is simply called volume difference or basal area difference, as the case may be.

second inventory.[3] The tally man records each tree in its diameter class and watches to see that the calipermen measure (not guess!) the diameter of each tree at breast height.

Because no trees are numbered, the cost of calipering is relatively low. In Switzerland the crew measures in an 8-hour day from 3,000 to 7,000 trees or from 10 to 25 acres. Were the trees numbered, only from one-fifth to one-tenth as much ground could be covered. The only question is, can results obtained in this fashion be put to as many uses as if every tree had been numbered? With a relatively large area covered, the results are much more reliable than from a small area.

Supplementary field work has to be done to establish a volume table, but whether this is done by measuring sample trees, using volume tables, or in some other way is of little importance.

Office Computations

Volume Increment.—The calculations of the volume increment is shown in Table 1. Usually the total number of trees in column 5 is higher than the number of trees of the first inventory, since during the interval several trees will have grown up to the fixed minimum diameter. The difference between the totals of columns 5 and 2 represents this growth, in German called "Einwachs" or "Zugang zum Hauptholz," in French "passage a la futaie"; in this paper it will hereafter be designated by the word "ingrowth." The total of column 6 shows the same difference. The total of column 8 represents, therefore, the volume increment of the trees measured at the first inventory plus the volume of the ingrowth, which can easily be calculated.

In our example we find 214 trees in the lowest diameter class of the second inventory. Because the ingrowth is only 16 trees, we assume that all these trees are in the lowest diameter class, since otherwise we would have to assume that some trees passed two or three diameter classes, while others did not move at all. If the ingrowth is higher than the number of trees in the lowest diameter class, we multiply the difference by the volume of the mean tree of the next diameter class; e. g., if the ingrowth were 250 trees instead of 16 trees, we find (Table 1):

Ingrowth in class 7 = 214 trees × 5.8 cubic feet = 1,241 cubic feet.

Ingrowth in class 9 = 36 trees × 11.1 cubic feet = 400 cubic feet.

Total ingrowth = 250 trees; 1,641 cubic feet.

Deducting the ingrowth from the total of column 8, we obtain the increment of the original stand, which is the increment of the trees measured the first time.

The above example deals with a pure stand. In mixed stands each species is recorded separately. If a volume table for each species can be prepared, the increment of each species can be calculated separately. If there is not a sufficient number of some species to make a separate volume table, several species are thrown together. In increment studies it is not of great importance to work with a volume table of high absolute accuracy, but it is necessary to use the same volume table for every inventory, otherwise differences in the volume tables would lead to errors in the calculated increment. For this reason it may be sufficient to use separate volume tables only for hardwoods and softwoods. Sometimes only one average volume table, covering every species, is used in continuous volume and increment control, such a volume table being called a "tarif."

[3] In measuring the trees always from the same direction, systematical errors are committed. But these errors are of no importance if the trees are measured the second time at the same place.

Naturally the accuracy of such a procedure is only relative. By means of a correction factor for each species, the separate volume of the species can be determined.

Basal area increment is calculated in exactly the same way as the volume increment. In column 7, instead of volume table or "tarif" values, we record the basal area of the mean tree of each diameter class. The ingrowth has to be calculated in the same way as for the volume increment.

Diameter Increment for Each Diameter Class.—For many purposes, such as to predict growth or to study mortality, a detailed analysis of the increment is required. Table 2 shows how the average diameter increment of each diameter class can be calculated on the basis of stand tables. For each diameter class the number of trees which have risen into the next higher ("rising," column 4) and the number of trees which remained in the same class ("stationary," column 5) have been calculated. The calculation has to begin with the highest diameter class; therefore this class is put at the top of the table, contrary to general practice.

In the 37-inch diameter class we find no tree at the time of the first inventory, but 2 trees in the second inventory. These 2 trees must have risen from the lower class; we note 2 trees rising in column 4 between the lines of class 35 and class 37. In the 35-inch diameter class, first inventory, we have 3 trees. Now, because 2 trees of this class have risen, 1 tree must have been stationary; we note

TABLE 1

CALCULATION OF THE PERIODIC VOLUME INCREMENT ON THE BASIS OF STAND TABLES FROM FIRST INVENTORY, OCTOBER 6, 1924, AND SECOND INVENTORY, NOVEMBER 24, 1934

Diameter breast high (Inches)	Trees at first inventory	Trees at second inventory	Trees removed in period	Trees at second inventory plus those removed[1]	Trees at second inventory plus those removed minus number at first inventory[2]	Volume per tree	Volume increment[3]
1	2	3	4	5	6	7	8
	Number	Number	Number	Number	Number	Cu. ft.	Cu. ft.
37	—	—	2	2	+ 2	414.6	+ 829
35	3	3	3	6	+ 3	359.8	+ 1,079
33	12	7	10	17	+ 5	309.4	+ 1,547
31	13	7	9	16	+ 3	263.7	+ 791
29	20	26	25	51	+ 31	222.0	+ 6,882
27	56	67	30	97	+ 41	185.2	+ 7,593
25	116	127	60	187	+ 71	151.8	+10,778
23	214	235	70	305	+ 91	122.8	+11,175
21	369	423	75	498	+129	94.4	+12,178
19	617	569	80	649	+ 32	75.3	+ 2,410
17	704	584	105	689	— 15	56.6	— 849
15	756	616	70	686	— 70	41.1	— 2,877
13	710	510	65	575	—135	28.4	— 3,834
11	556	388	72	460	— 96	18.5	— 1,776
9	351	255	36	291	— 60	11.1	— 666
7	230	185	29	214	— 16	5.8	— 93
Total	4,727	4,002	741	4,743 —4,727	+ 16		+45,167
Ingrowth				+ 16	16	5.8	93

[1]Column 3 + column 4.
[2]Column 5 — column 2.
[3]Column 6 × column 7.

1 tree stationary in column 5 in the line for the 35-inch class. In the 35-inch diameter class, at the second inventory, we have 6 trees; 1 tree was stationary, therefore 5 trees must have risen: we note 5 trees rising in column 4. Of the 12 trees, first inventory, 33-inch class, 7 trees were stationary, and so on. At the foot of the sheet, we find that 16 trees have grown into class 7. This number represents the ingrowth and is equal to the difference between the totals of columns 2 and 3. This difference checks with the last figure in column 4. If the trees grow through more than one diameter class, this results in a negative number of trees being stationary; but taking care of the proper signs the procedure of calculating the diameter increment is the same as before.

The next step, given in columns 6 and 7, is the calculation of the mean number of trees contained in each diameter class (during the period) and the mean number of trees rising in and out of every diameter class.[4] We add two neighboring figures in column 4 and put down the sum on the line in column 6 between these figures. For example:

"Double rising" 37-inch class $= 0 + 2 = 2$.

"Double rising" 35-inch class $= 2 + 5 = 7$.

"Double rising" 33-inch class $= 5 + 10 = 15$, etc.

In column 7 the sum of the number of trees of the first and second inventories is calculated for each diameter class and called "double effective."

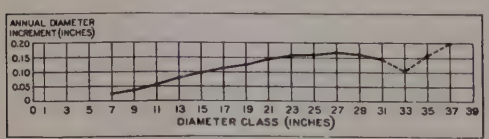

Fig. 1.—Average diameter increment per year in different diameter classes.

Now, if we assume that the number of trees is evenly distributed in each diameter class, it is easy to see that the percentage of trees rising out of a class, which corresponds to the quotient $\frac{\text{double rising}}{\text{double effective}}$, is directly proportional to the periodic diameter increment. But it can be proved that because of calculating, the "double rising" and the "double effective," we also obtain accurate results in the case of an uneven stem distribution. If all the trees of a diameter class were to rise, the diameter increment would be equal to the size of the diameter class, which we have taken as 2 inches (column 1, Table 2). If 50 per cent were to rise, the increment would be 0.5×2 inches, $= 1$ inch. We determine, therefore, in column 8, the quotient $\frac{\text{double rising}}{\text{double effective}}$. To get the diameter growth per year, we have to multiply this quotient by the size of the diameter class and divide it by the number of years in the period; this is done in column 9. In Figure 1 the average diameter increment of each diameter class obtained in column 9 is represented graphically. We see that the trend of the curve, giving the diameter increment as a function of diameter at breast height, becomes irregular in the highest diameter classes, where only a few trees form the basis of the calculation. In Table 2, column 9, these unreliable figures are put in brackets. The graph shows that the big trees of the stand still have a vigorous diameter increment, while the smaller and probably suppressed trees are growing at a much slower rate. It is clear

[4] In practice we calculate the *double* mean. Afterwards it is not necessary to divide these figures by two, because the quotient of the figures in column 6 and 7 is calculated, so that the factor ½ drops out automatically.

that for many purposes such a curve is of definite practical value.

Accuracy of the Method

The method is of practical value only if it works with a sufficient degree of accuracy. Roughly, the mean error of the calculated periodic increment will equal the square root of the sum of the squares of the mean errors in the diameter measurements at the time of the two inventories. Since the periodic increment is directly proportional to the number of

Table 2

Calculation of the average diameter increment by diameter class
1st inventory data: October 6, 1924
2d inventory data: November 24, 1934

Diameter breast high inches	Trees at first inventory	Trees at second inventory plus trees removed	Trees rising in period	Trees stationary	Trees double rising	Trees double effective[1]	Trees double rising / double effective[2]	Annual diameter increment[3]
1	2	3	4	5	6	7	8	9
	Number	Number	Number	Number	Number	Number		Inches
37	—	2	2	—	2	2	(1.00)	(0.200)
35	3	6	5	1	7	9	(0.78)	(0.156)
33	12	17	10	7	15	29	(0.52)	(0.104)
31	13	16	13	3	23	29	0.79	0.158
29	20	51	44	7	57	71	0.80	0.160
27	56	97	85	12	129	153	0.84	0.168
25	116	187	156	31	241	303	0.80	0.160
23	214	305	247	58	403	519	0.78	0.156
21	369	498	376	122	623	867	0.72	0.144
19	617	649	408	241	784	1,266	0.62	0.124
17	704	689	393	296	801	1,393	0 58	0.116
15	756	686	323	363	716	1,442	0.50	0.100
13	710	575	188	387	511	1,285	0.40	0.080
11	556	460	92	368	280	1,016	0.28	0.056
9	351	291	32	259	124	642	0.19	0.038
7	230	214	16	198	48	444	0.11	0.022
Total	4,727	4,743 4,727		—	4,764	9,470	0.50	0.100
Ingrowth		16						

[1]Column 2 + column 3.

[2]$\frac{\text{Column 6}}{\text{Column 7}}$

[3]$\frac{\text{Column 6}}{\text{Column 7}} \times \frac{\text{2 inches}}{\text{10 years}}$.

years in the period, the longer the period the smaller the percentage of the error. Also, the larger the number of trees measured, the smaller this percentage will be.

Obviously, the period between the two inventories should not be too short—with a mean annual growth of 2 or 3 per cent, not less than 6 to 10 years. Reliable figures of the mean error of a volume increment calculation can be given only in connection with a well-defined method of measurement. The method as applied in Switzerland works with an accuracy of 2 to 5 per cent (mean error) of the increment, if the periodic increment is about 20 per cent of the stand volume. Of first importance among the factors influencing the accuracy of an increment determination is the accuracy of the calipers used in making the inventories.

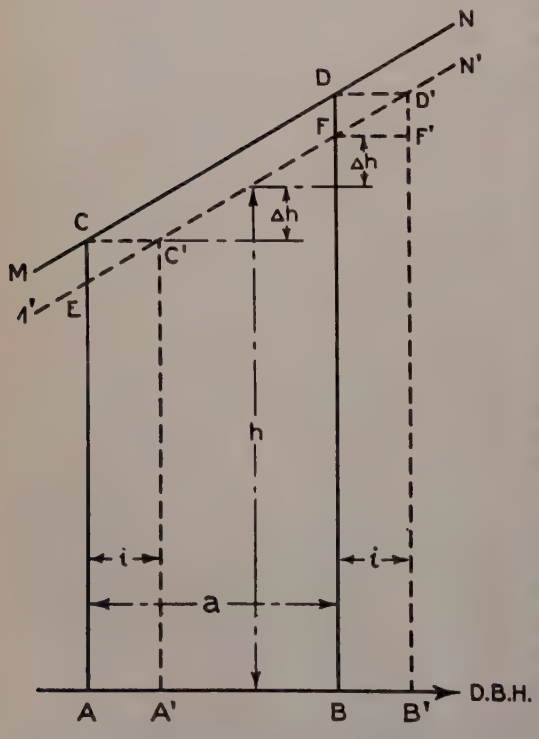

Fig. 2.—Method of representing trees unevenly distributed in a diameter interval.

Other errors are introduced if the diameter is not measured always at the same height and from the same direction. Less important is the size of the diameter classes; below 1 inch the method becomes inapplicable.

With respect to the accuracy of the diameter increment calculation, although at first sight it seems that the result of dividing the number of trees rising by the number of trees effective is proportional to the diameter increment only if the trees are evenly distributed in a class, it can be shown that this conclusion is erroneous.

We assume that this distribution in a certain diameter interval somewhat bigger than a diameter class may be represented by a straight line (Fig. 2). The number of trees in a certain interval is represented by the *surface included* by the x axis, the distribution curve (which is here a straight line), and the two ordinates erected at the limits of the interval. The line MN represents the distribution of the first inventory, $M'N'$ the distribution of the second inventory, including the removed trees. The size of a diameter class is designated by a, the periodic diameter increment by i. The distribution curve MN will be displaced i units to the right at the end of the period. Its new position is represented by the line $M'N'$. The corners of different surfaces are designated with capital letters, the length of lines with small letters.

If the diameter increment is i, the number of trees contained in a certain diameter class AB, and represented by the surface $ABDC$, becomes, afer a certain period in the interval, $A'B'$, represented by the surface $A'B'D'C'$. The ordinate erected in the middle between A' and B' reaching from the x axis to the line $M'N'$, is designated by h. Two other distances are designated by Δh.

It has to be proved that for an uneven distribution of the number of trees in a diameter interval, as it is represented in Figure 2, the diameter increment can be calculated out of the equation $i = \frac{\text{double rising}}{\text{double effective}} \times a$, as has been done in Table 2. The following geometrical proof may be understood without further explanations.

By definition,

$$\begin{aligned}\text{Double rising} &= \text{surfaces } AA'C'E + BB'D'F \\ &= (AA'C'C - EC'C) + (BB'F' + FF'D')\end{aligned}$$

But $EC'C = FF'D$. Therefore,

$$\begin{aligned}\text{Double rising} &= AA'C'C + BB'F'F \\ &= i(h - \Delta h) + i(h + \Delta h) \\ &= 2\ ih\end{aligned}$$

By definition, also,

$$\begin{aligned}\text{Double effective} &= \text{surfaces } ABFE + ABDC \\ &= ABFE + A'B'D'C' \\ &= AA'C'E + BB'D'F + 2(A'BFC')\end{aligned}$$

Now $AA'C'E + BB'D'F$ = double rising by definition, and as shown above is equal to 2 ih. Substituting,

$$\begin{aligned}\text{Double effective} &= 2\ ih - 2(a - i)h \\ &= 2\ ah\end{aligned}$$

The ratio of double rising and double effective is therefore,

$$\frac{2\ ih}{2\ ah} = \frac{i}{a}$$

$$\text{and } i + \text{diameter increment} = \frac{\text{Double rising}}{\text{Double effective}} \times a$$

Practical Application of the Method

The above method for determining current volume increment, basal area increment, and average diameter increment for each diameter class can be applied to sample plots, strips, whole stands, and forests. It is especially suited to large areas, because of its speed and relative cheapness. The method is the same in every case, but the results are reliable only when based on the measurement of a sufficient number of trees. A few notes on the application of the method in the different cases may be helpful.

Increment Studies on Sample Plots

In this, as in all other methods, the plot should not be too small. In older stands where there are fewer trees per acre, the area should be larger than in younger stands.

Sample plots may be established not only to compare the growth of two or more stands of different forest types, species, etc., but also to form the basis for determining sustained yields. In this case, we have to consider the increment of the whole working circle. By adding the stand tables of all plots a useful increment calculation can be made even if the single plots are relatively small.

Increment Studies over Larger Areas

To determine the yield of a forest, it is sufficient to know the increment of the older stands, or, if the forest is uneven-aged, to know the increment of the larger trees. Therefore the diameter limit for calipering trees may be somewhat below the diameter of merchantable timber. In even-aged forests the older stand may be calipered throughout, or the increment

may be determined on sample plots. Uneven-aged stands should only be measured if about half the volume is contained in trees above the fixed diameter limit.

Survey by Strips

If permanent strips are established in a forest and remeasured after a certain period, the procedure is the same as for permanent sample plots. If the measured trees have been scribed they can easily be found when making the second inventory, and it is not even necessary to mark the boundary of the strip. Naturally the diameter of the removed trees located in the strip must be measured.

The calculation of the periodic increment based on non-permanent strips will be rather difficult, because the mean error in the estimated volume of the forest is comparatively high. This will cause the error in the increment to be still higher. In this case growth studies based on increment cores will give better results, although a new difficulty is introduced by the lack of direct measurement of dead and removed trees.

Summary

Knowledge of the mean annual or periodic increment is essential in forest management and is also important in research work. A simple method of periodic control of volume and increment based on stand tables was invented by the French forester, H. Gurnaud, and has been applied on a large scale by the Swiss forester, H. E. Biolley. Two inventories and a stand table of the removed trees are necessary to calculate the periodic growth by this method, and the usual additional field work is required to make one or more volume tables. Calculation of volume increment, increment of the basal area, and diameter increment for each diameter class can be made on one large sheet of paper.

The accuracy of the calculation of the volume increment is sufficient for practical purposes, the mean error being 2 to 5 per cent where the increment is 20 per cent of the stand volume. The theoretical basis of the French method to calculate the average diameter increment per diameter class has been proved.

The advantages of the method are: (1) It is cheap, because no trees need be numbered; (2) it is applicable to increment studies on large areas as well as to permanent sample plots and survey strips; (3) the same field work gives the basis for calculating the total volume increment, the increment of the basal area, and the diameter increment by diameter class; (4) the office computations are short and simple; and (5) the method is equally applicable to research and to practical work. Disadvantages are: (1) A large number of trees has to be measured to obtain good results; (2) several years must pass before the increment of a stand or a forest can be determined; and (3) the diameter breast high of the removed trees has to be measured, which in certain cases is difficult.

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PROTECTIVE BURNING IN HIMALAYAN PINE

By R. MACLAGAN GORRIE, D.Sc.

A RECENT visit to parts of the southern longleaf and western yellow pine belts of the United States has served to show the singularly close comparisons which lie between these types and the Himalayan *Pinus longifolia*, or chir pine. In its habit of growth, heavy needle-fall, and value as a resin producer the chir reassembles the *Pinus palustris* of the southern states, but in its choice of terrain it is closer to the western *ponderosa*, preferring steep slopes and avoiding flat ground entirely. Its climatic limits correspond roughly with those of both the American species, but it is capable of resisting more intense drought and heat than either of them.

The chir occurs in a belt stretching for hundreds of miles along the outer ranges of the western Himalayan foothills from about 2,500 to 6,000 feet elevation. At its eastern and wetter extremity it can stand an annual rainfall of over 100 inches, most of which occurs in two months' almost continuous summer monsoon rain, with very dry periods both before and after. At its western and drier limit the total drops to 20 inches annually, most of it concentrated in a few terrifically heavy summer thunderstorms, with a little of it in gentler winter rain and snow. Even in the damper part of its belt there are two well-marked dry seasons in spring and autumn, and these are accentuated as one goes north-westwards out of the zone of effective monsoon rain.

The arid heat of the summer months, with its amazingly low humidity, gives rise to a very serious fire danger. Ground surface temperatures of 160 Fahrenheit, with humidity readings of 5 to 6 per cent during the midday hours, are quite common during April, May, and June. The autumn drought does not produce such high sun temperatures, but the humidity is even lower, and delay in the arrival of the first winter snowfall in December may produce really dangerous fire conditions.

Fire appears to be an inevitable factor in the development of the chir pine, which through thousands of years of periodic conflagrations caused by lightning and by man has evolved a fire protective technique of its own. It is one of the few pines which can in its younger stages persist underground and sprout again year after year in face of repeated burning, while in its older stages from the pole size onwards its heavy bark protects it most efficiently. Even the chir, however, will succumb to continued burning in its youth, while a single really virulent conflagration in an area previously unburnt for a number of years will lay waste many miles of forest of all ages. As in the American pines, the crown fire is more disastrous than the surface fire, and the most vulnerable forest is the natural one in which all ages of tree are found in the same crop, because a fire starting on the ground climbs inevitably through seedling and sapling groups into the crowns of the mature crop. Complete protection for several years leaves an accumulation of heavy needle-fall and desiccated grass tufts which together form a veritable tinder box, and it is only a matter of time before some agent touches this off in a bonfire.

The position is complicated by the hill-folks' firm belief that good fresh

grass for their huge herds of hungry cattle, sheep, and goats can only be obtained by burning off the old grass, preferably just before the monsoon rains set in, when the country is at its very driest. The effect of burning at this stage is of course to pulverize the soil and expose it completely by destroying the whole of the top cover of decomposing organic matter, just at the time when the relentless first downpours of the monsoon can do most damage in washing away the unprotected soil.

The shade of the chir, like that of most pines, is inimical to heavy undergrowth where its canopy is at all dense, and in well stocked pole forest the floor is a mat of dry needles with only occasional low bushes such as *Berberis lycium, Dodonea viscosa,* and *Carissa opaca,* all of which are highly inflammable. In more open forest and mature stands there is more grass growth, and this is particularly true of hot southern exposures in the arid country of the western Punjab and the north-west Frontier Province, where intentional burning by villagers to obtain fresh grass has been most difficult to deal with. In damper reentrants and on cooler slopes the pine often occurs with an understory of *Quercus incana* and other broadleaf species such as *Rhododendron arboreum* and *Pieris ovalifolia;* and in such places the presence of a mixture tends to reduce the fire danger appreciably.

About 1910 the first attempts were made in the Rawalpindi forests to introduce some system of "controlled burning" in the same sense as employed by E. L. Demmon in his recent paper in Washington (2). As experience was gained, the periodic burning during winter of more and more of the pole crops and mature stands was undertaken, and was scheduled as a prescription of the working plan in 1914. This working plan was based on the periodic block system, regeneration work being confined to a sixth of the total area of the chir forest. Protective burning was first applied to pole crops and to mature crops not yet opened up for regeneration, fire being rigidly excluded from areas containing saplings and seedlings. Several years of protection in the regeneration areas were, however, inevitably followed by summer fires which wiped out many years of careful work on the young crop, the worst being in 1921, when political agitation led to widespread forest incendiarism coinciding with three years of rainfall shortage. Following this experience, efforts were made to put controlled fire through sapling crops in partially regenerated areas. During the last few years this has been further developed, and it is now recognized that, given careful supervision and a skillful choice of weather conditions for the operation, controlled burning can be carried out in very young crops. Controlled burning is now a routine measure in almost all chir pine forests in the Punjab and the United Provinces, though opinions vary as to the advisability of burning in very young stands rather than protecting them rigidly against fire till they are in the tall sapling stage.

Labor conditions are good, in so far as village labor is cheap and plentiful at seasons when their farm crops are not monopolizing their time. Villagers in resin tapping areas derive most of their hard cash from resin work, and are therefore interested in fire protection. Elsewhere grazing communities would still prefer summer conflagrations, but have accepted the winter burning arrangements as being better than continuous protection. In most government forests grazing and other rights are admitted in the legally binding "forest settlement" for the district, in return for

which the right-holders are bound to help with fire protection, so that we get a fair amount of completely free labor for this work. On the other hand there is no fire-fighting equipment, and under American conditions a small squad armed with blow-lamps for igniting the duff, and with pack extinguishers for controlling it, could do as much work in a day as is undertaken by a whole village population of rather primitive right-holders.

In poles and older crops the work can be carried out on any windless winter day within a few weeks after the last rain or snow-melt. A section of forest bounded by two stream-beds is taken up, starting at the top of the slope and working gradually downhill in strips. The fire is spread by one or two trustworthy men, the rest of the squad being used in controlling the rate of spread. A few men are posted some distance downhill to catch any rolling cones, which often serve to start fires away downhill and envelop the squad in an uncontrolled blaze at their backs. If the ground is fairly wet it requires much patience to see that all combustible material is actually burned up. If too dry, it requires much hard work to keep the fire under control, and a correspondingly narrower strip can therefore be lit safely at one time. Trees bearing resin blazes must have their bases swept clear of needles so that the fire will not reach them.

Burning is done regularly every second or third year, according to the intensity of protection needed. Places adjoining villages and roads require most attention, but the intensity of grazing and grass-cutting and the danger of graziers trying to do their burning in the summer all have to be considered. The former practice of "punitive closures," by which villagers responsible for serious forest crimes were deprived of their grazing or grass-cutting rights for a number of years, has been done away with entirely, as it was found to lead to more widespread incendiarism.

In felling areas littered with felling slash and the refuse from hand-sawing, which is done on the spot, a thorough burning is necessary to clear the ground and prepare it as a seedbed. Such work constitutes a separate operation. Branchwood is heaped up into small piles, using three or four logs as the base of each pile so that the logs themselves will be consumed or thoroughly charred. Where existing regeneration has to be saved it must be isolated by the sweeping of needles and removal of slash from a safety zone all around it (5).

In applying protective burning to regeneration areas more or less fully stocked with sapling and seedling crops, patches of young trees over 7 feet high can be dealt with in the same way as older crops, but must be segregated by cleared strips from younger clumps. Those of from 3 to 7 feet in height have developed bark thick enough to withstand a slight fire, and the needle mat around them can be burnt provided all debris and fallen logs and branches have been collected and large nests of dry needles lodging in whorls of branches have been removed. Seedlings usually reach a height of 3 feet in 5 or 6 years if they have not been interfered with by grazing, browsing, or accidental fires. Below this size they will almost certainly die back after even the slightest fire, so that they should be fully protected. A detailed description of the technique of burning in young crops is given in the Indian Forester of 1932 (1).

The ecological effect of burning the needle-fall every second or third year throughout the life of the tree must, of course, be considerable. Controlled burning was introduced only after the foresters had despaired of saving these forests by any other means. In the chir pine one has to admit that fire is an inevitable and governing factor. It is quite

useless to theorise over what further ecological stage might succeed the chir if fire could be omitted from the picture. Fire cannot be omitted, and having accepted fire as inevitable, we can differentiate in practice between bad fires and fires which are not so bad. The amount of destruction wrought by a bonfire at the end of a hot dry summer in an area which contains several years' accumulation of needle-fall, young regeneration, and felling debris, has to be seen to be believed. The entire series of organic humus layers is wiped out, leaving pulverized earth and charcoal dust at the mercy of the first rain-storm. The longer the delay the more complete is the holocaust, and even if this happens only once in 30 years, the resultant damage in terms of loss of organic content washed away must be more than in ten or fifteen controlled burnings, each of which merely consumes the top layer of newly fallen needles without doing much material damage to the underlying decomposed humus layer. Also, the fact of its being winter burning reduces the erosion damage appreciably because the grass and ground cover have time to recover and reclothe the ground before the heavier monsoon storms arrive. Ecologically, therefore, it would seem that properly controlled winter burning is not so suicidal as it was thought to be by a previous generation of foresters. When controlled burning is first introduced in any forest which has been protected for some time, the first burning is naturally a much more serious one than the subsequent repetitions, and the local staff has not yet settled down to the drill for such work. The first attempts, therefore, need diligent preparation and careful choice of windless weather if the operation is to be successful.

Much of the lower chir pine belt runs through the soft sandrock ranges of the Siwalik foothills, and in Hoshiarpur and Kangra this type of soil is peculiarly liable to erosion. Either continuous heavy grazing or periodic burning will so weaken the ground cover and expose the friable sandy loam that very serious erosion follows inevitably. In such places the aim is to encourage grass-cutting in preference to either grazing or burning, but oriental lethargy is hard to overcome. It is so much easier to send out the village herd to graze each day in charge of a few small boys, rather than for the adults to go in for grass-cutting and stall-feeding their animals.

In the chir's higher level the blue pine (*Pinus excelsa*) tends to increase at the chir's expense and to extend downhill. The effect of eliminating or reducing fire damage is curiously parallel with what happens in the southern longleaf as described by Wahlenberg (6). In many places where a heavy seeding felling has been made in a mature chir crop above 5,000 feet elevation, leaving only 8 to 10 seed trees per acre, the young crop which has come in is almost pure blue pine. As the blue pine is much more vulnerable to fire damage and is not at present tapped for resin, the change may be ecological progression, but is a doubtful improvement.

The chemical improvement in burnt pine soil recently analyzed by Heyward and Barnette (4) has been appreciated in India for some time, for although similar analytical data have not been produced, the preparation of seedbeds by burning has been established as a regular routine in the case of both pine and deodar, as the rate of growth of seedlings is quite appreciably improved thereby. In view of so many close parallels in the Himalayan and American pine problems, the recent data on the interrelations of fire and grazing given by S. W. Greene (3) are of particular interest to us in India.

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NO progress has yet been made in regard to the situation in the Forestry Branch in Ontario. The Secretary has been advised by those in close touch with matters that the time is not yet ripe to approach the Premier. The Society can only concern itself with policies and cannot demand that this or that man be hired or fired. It can demand that proper policies be carried out and that politics should not be allowed to enter into the matter at all. It may be interesting to the members to know just what has happened in regard to personnel in the Ontario Forestry Branch. One hundred and thirteen employees were discharged with service records of from one to twenty-three years. Seventy-nine were married and had dependents, twenty-nine were returned soldiers. Among them were 5 district foresters, 5 assistant foresters and 2 division foresters, 34 deputy chief fire rangers, 9 chief fire rangers and 14 mechanics. Eight of the foresters discharged were members of the Society, 4 were not. Some of the men were taken on again. The substitution of a non-technical for a technical deputy minister is to be deplored. Some of the men were replaced for purely political reasons and some were insulted and much hardship was caused. Unqualified political appointments to the forestry service should not be allowed and we should bend our efforts to the elimination of such.—*Canadian Society of Forest Engineers, News Bulletin.*

THE PLACE OF UTILIZATION IN FORESTRY

By C. P. CRONK

Wellesley, Mass.

IN THE Copeland Report under Major Forest Problems[1] occurs the following statement: "Despite some reason for gratification in past accomplishments, the American people have no reason to be proud of what still remains to be done to put forestry on a satisfactory footing in the United States;" and again[2] regarding the economic difficulties of the forest industries, "No survey of the forest situation in the United States can be complete without reference to them." Thus, in the most exhaustive survey of forestry yet undertaken is made acknowledgement of the weakness in the present scheme of things. If or when forestry reaches a satisfactory footing in the United States, the efficient utilization of our forest products will be a vital factor in that accomplishment.

Forestry in the United States may be said to have had its birth in 1876 when a special agent of the Department of Agriculture was appointed to study forestry conditions then existing. The growth of forestry to the present has been by stages of approximately thirty years each: the first up to the forming of the Forest Service in 1905, introduction; the second from 1905 to 1935, mainly organization and inauguration of silvicultural plans; a third which we are now entering should see a major emphasis on improved methods of utilization and distribution. Except for those timberland owners who owned pulp mills or a few courageous lumbermen who were early converted to the advantage of a "sustained yield," it is fair to say that during the thirty years just ending the interest in forestry, other than administration, has been a silvicultural one, the ultimate utilization being secondary. This statement is made without criticism and with full recognition of the excellent work of the Forest Products Laboratory, on which further comment will later be made. After the building of organization it was logical that the next inclination should be toward perfecting the silvicultural condition of the forests, particularly so in view of the then still expanding trend of the lumber industry and the avowed purpose of creating the National Forests as reservoirs from which to draw, after private timberland should be devastated.

Without belittling the importance of silvicultural practice nor research therein, for which adequate plans now seem to be established, most foresters who have been associated with the manufacture or distribution of forest products agree that the greatest challenge in our next period of development will be in utilization, or if one prefers, in forest economics as related to utilization and distribution. Though the grave difficulties which beset all lumber-producing and wood-using industries are recognized, this paper will confine itself to questions of New England. Listing some of the salient problems of one region will indicate the essential role to be played by utilization in the success or failure of the next stage of forestry.

The Lumber Industry

1. *New Uses for Low Grades.*—Where may be found other uses, either mechani-

[1] P. 11.
[2] P. 15.

cal or chemical, for low grade "box" white pine, since the waning of the wooden box industry? Where are further markets for the preponderance of low grade hardwoods?

2. *Forced Cutting of Immature Timber.*—How and when will the method of taxation be so adjusted that the land owner does not feel forced to insist on clear cutting of thrifty pines 5 and 6 inches in diameter, forcing the logger and millman to cut such trees at a recognized loss in order to obtain timber of truly merchantable size and quality?

3. *Thinnings.*—How, to what extent, and when may markets be developed for thinnings and weedings, now usually unmarketable?

4. *Round-edged Lumber.*—Is the continuance of emphasis on the manufacture of round-edged (flitch-sawn) lumber, both hardwoods and softwoods, desirable or necessary? Must square-edged replace round-edged lumber in order to compete with that of other regions, even though the utilization through round-edged sawing is more complete? If desirable, can the change to square-edged lumber be accomplished without irreparable damage to regional industries built up on the use of round-edged stock?

5. *Sawmills.*—Has the portable sawmill outlived its usefulness? What will be the trend in relation of portable to stationary sawmills? What will be the trend in types and size of mills? What improvements in equipment may be necessary or desirable?

6. *Hardwood Dimension Stock.*—In what measure is the failure of many efforts in the manufacture of dimension stock due to low quality of timber, lack of equipment, or inadequate marketing?

7. *Grading and Grade-marking.*—To what degree is it practical for New England manufacturers of white pine to define their segregation of grades in parallel manner to the Lake States or Northern Pinery, the Inland Empire, the West Coast, and Canada? Are different grades for round-edged and square-edged softwoods desirable? Is it practical to insist on the grading of small lots of mixed hardwood cut incidentally in the logging of a softwoods lot? Can any arrangement be developed to make it reasonably cheap and convenient for the small mill operator to have his lumber graded? How much of it will warrant any expense for grading? In so far as grading may be feasible at relatively small mills, is grade-marking?

8. *Distribution.*—Is the present method of distribution through wholesalers adequate? Does or will co-operative marketing hold forth any promise to the small operator? Under what circumstances might concentration yards be advantageous and workable?

Wood-using Industries

1. *Size of Industrial Units.*—In a region which, for the present, has passed its zenith as a producer but will always be an important consumer, there are logically two types of plants, those near the source of supply, which are of especial value to the surrounding region, and those located in the large industrial centers, which are of marketing interest to a number of producing regions. To the region, as a whole, both are essential. What is the most desirable relation of the small industries to the large ones? How large a possible market is there for parts, partly manufactured in the small plants, to be completed or assembled in the large ones, to the advantage of both? What types of work can the large plants perform better than the small ones and vice versa?

2. *Village Industries.*—What is the history of the local industries in the region, state, or section thereof? What changes have been due to deterioration of quality of timber or entire depletion of necessary raw material; what due to economic conditions beyond control of the

individual industry? From the past what can we learn of the possibilities for the future; which industries may be retrieved and which have gone for good? How can the precarious existence of many of the present essential industries be first preserved and then strengthened? What are the present machine and human capacities for individual working circles? What are the potentialities? What are the prospects for new industries of the type necessary to fill out the production of the working circle, using to best advantage the species and quality of timber available, and the mental or mechanical capacities of the individuals of the community? How will present production or probable trend be influenced by the working toward a sustained yield basis?

Pulp and Paper Industry

This article has not discussed the problems of the pulp and paper industry because it is so far ahead of the rest of the forest industries in the study of its individual problems. The remarkable range of cellulose products, offshoots of the industry, brought forth in recent years, show the returns from persistent research.

Such are the problems of one region. The gigantic features of the West Coast lumber industry: namely, the average daily or annual output per mill, the size and speed of the machines to make this output possible, the nature of the logging equipment, the areas of timberland to keep an individual mill going, the resultant staggering initial costs, running expenses, and carrying charges—these make the problems of the western forests spectacular in creating attention: other forest regions present difficulties just as insistent in demanding a solution.

The colossal structure of the Forest Products Laboratory at Madison in comparison to its modest beginning in 1910 is an acknowledgment of the need for research in utilization. Scientific and technological studies carried on by the staff of the Laboratory have been of definite value to all the forest industries. Many of its industrial investigations are of a scope and thoroughness practically impossible for any regional or local agency to equal. The division of forest economics of the branch of research of the federal Forest Service, the lumber division of the Department of Commerce, with its allied National Committee on Wood Utilization, The National Lumber Manufacturers Association, and a number of regional lumber producing organizations have all added to the fund of general information or to that of certain specific industries. But withal, this is no more than a beginning.

A few foresters still either infer or assert the opinion that a forester's responsibility ends with the raising of timber and extends incidentally to the uses made of it. The discouraged, disheartened, hopeless attitude of many whose life work and earnings are today tied up in the forest industries is an incontrovertible argument that the quest for new uses for wood should be unrelenting and that the economics of efficient production and distribution receive their due in order that the industries may once more attain a healthy condition. Who should be as well qualified to lead in this rejuvenation as those possessing the basic training of the forester, his sympathetic understanding of the problems with which the industries of utilization are confronted, and his comprehension of the requirements of silviculture? Forest utilization then, with all that the term implies, must be of supreme concern in our progress toward an ultimate sustained yield policy. In the struggle of the forest industries to insure an adequate financial return to the practice of silviculture, in the efforts at rehabilitation of the numberless communities whose economic and social well-being depend on the proper and efficient use of forest resources, will the profession of forestry assume its rightful lead?

BRIEFER ARTICLES AND NOTES

The Lewis Bill
(progress of events to date—august 5, 1935)

The Senate Bill 2665, entitled "A Bill to Change the Name of the Department of the Interior and to Coordinate Certain Governmental Functions," has been reported out by the Committee on Expenditures in the Executive Departments. It is now on the Senate calendar and as this story is being written, may come up for vote any day. The sister bill, H. R. 7712, is still in committee. The House Committee on Expenditures in the Executive Departments held a series of hearings in July at which President Chapman, representing the Society of American Foresters, presented testimony in opposition (as noted in the July Journal the Executive Secretary testified before the Senate Committee). The main committee then turned the bill over to a sub-committee, Hon. William M. Whittington, Chairman, to consider the possibility of certain amendments, the need for which may have been indicated by the discussions at the hearings. This sub-committee, at present writing, has taken no action.

Four S. A. F. press releases relating to the bill have been issued. The second, prepared by President Chapman and put out under date of June 24, was reproduced in the August Journal for the information of the Society. This gave rise to the Ickes-Chapman letters published in the same number, and also issued to the press. Under date of July 22 a third and much longer release, prepared by Chapman, set forth in amplified form the grounds for opposing the measure. Space limitations preclude publishing it in the present number of the Journal.

The fourth release under date of August 10 contained the below quoted letter from Secretary Ickes to the Executive Secretary and President Chapman's reply to it.

The Executive Secretary, on July 20, conferred with President Chapman at New Haven. After his return to Washington, under date of July 27, he addressed a letter to House Sub-committee Chairman Whittington, in which he proposed that the Interior Department, if its name must be changed, be called the Department of Public Works and Conservation of Inorganic Natural Resources. He also proposed that Section 2 of the bill be reworded so as to give the Executive two-way transfer authority, viz., permit him not only to transfer *to* the Interior Department such bureaus as he might deem proper, but also authorize him to transfer *from* Interior those certain organic conservation agencies which would function more efficiently in Agriculture. On July 29, the Executive Secretary addressed to every U. S. Senator a one page letter, giving in condensed form the Society of American Forester's arguments against the bill and urging them to oppose it. This Senators' letter came to the attention of Secretary Ickes and he wrote the Executive Secretary as follows:

"I have before me a copy of your circular letter that went out to members of the Senate under date of July 29, in which you express your opposition to S. 2665. I note that you say that 'Deliberately to change the name of the department from 'Interior' to 'Conservation' would constitute a mandate on the Ex-

ecutive to group under that Department all services, bureaus, and other agencies whose purpose it is to conserve the thing with which they deal."

"This statement is either a deliberate misrepresentation of facts or it is positive proof that you are incapable of understanding the clear intendment of plain English. If it is the former, may I say that while it is your privilege to oppose this bill, your opposition ought to be based on honest grounds."

Several of the Senators have acknowledged this letter—most of them noncommittally, as is the usual custom. Two of them (on the Republican side) have expressed their opposition to the bill.

Since the above was written (on August 5) Senator Lewis brought the bill up on the floor of the Senate. Strong objection was evinced and it was passed over. Secretary Ickes, through personal letters to all the Senators, has been making strenuous effort to have the bill brought up again and voted on. In the meantime the House Committee, so the story goes, has decided not to report the bill out. At present writing (August 21) it looks as if the bill would not pass this session. Further happenings, if any, will be reported in the October issue.

FRANKLIN REED,
Executive Secretary.

SOCIETY OPPOSES GRANTING NATIONAL FOREST LANDS TO STATES FOR PARKS, PARKWAYS, AND RECREATION AREAS

On behalf of the Society, President Chapman has urged defeat of two bills (S. 738 and H. R. 6594) as inimical to public conservation interest. "Under the terms of these bills," he said in a press release dated July 27, "which are entitled 'To aid in providing the people of the United States with adequate facilities for park, parkway, and recreational-area purposes, and to provide for the transfer of certain lands chiefly valuable for such purposes to States and political subdivisions thereof,' and both of which have been reported out favorably by the respective committees, the Secretary of the Interior is empowered to transfer to any state or political subdivision thereof, by lease or patent, land within any national forest which, in his opinion, is chiefly valuable for park, parkway, or recreational area use by states or political subdivisions thereof.

"This power," continues Professor Chapman, "so given to the Secretary is arbitrary and can be exercised without consulting the Department of Agriculture which has jurisdiction over the national forests, and regardless of any problems which might exist in coordinating other uses of the areas in question by the Forest Service.

"Protests of the Secretary of Agriculture to this granting of authority to another department to dismember the national forests without consulting the department responsible for their efficient administration were ignored by both commitees and the bills, as reported out, swept away all safeguards which would have required cooperation or consent.

"The natural resources board in its final report emphasized the principle that the only sound policy of administration of natural resources is territorial rather than functional. The national forests, which annually care for over 31 million recreationalists as against less than 4 million in the national parks, have perfected the principle of coordinated multiple use of land for all purposes, and if retained as an integral part of these forests, the camp grounds and other opportunities for recreation will continue to be administered with a minimum of cost and to the satisfaction of the public. If the principle of separate jurisdiction over a functional use such as recreation, within the national forest,

is given to another department, even to the power of alienating any land which this department decides to take, the result must inevitably be a great loss of efficiency and increased expense in administration."

The Canadian Meeting

At the invitation of Ellwood Wilson, Executive Secretary of the Canadian S. F. E., and Aleck Koroleff, Forester for the Woodlands Section of the Canadian Pulp and Paper Association (both of them members of the S. A. F.), the Executive Secretary spent July 6-10 at Petawawa and Ottawa, Ontario, at the joint summer meeting of those two organizations.

It was a hands-across-the-international-boundary mission, and it worked to the mutual advantage of the profession in both countries. Many of the Canadians are also members, past or present, of our American Society and it is to be regretted that we cannot say "vice versa." The profession on both sides of the line has many problems of common interest to work out—silvicultural, economic, and political. In some instances Canada has learned how to do it better than the states, in other cases it is the reverse. The profession in each country has much to give and to receive from the other, to the profit of both.

Urgent invitation was extended to all the Canadians to join with us in our annual meeting at Atlanta next January. Many expressed a strong desire to do so and it is to be hoped that a goodly number will find the ways and means to come.

Extracts from Ellwood Wilson's official report of the meeting follow.

Franklin Reed,
Executive Secretary.

"The summer meeting held jointly with the Woodlands Section of the Canadian Pulp & Paper Association at the Petawawa Forestry Reserve of the Dominion Government was an unqualified success. Those attending were housed in large marquees equipped with double deck camp beds, furnished by the Militia Department. The meals were served in the unemployment camp which is conducted by the Militia Department.

"The Hon. T. G. Murphy, Minister of the Interior, was with us for two days. Maj. Gen. A. G. L. McNaughton also took an active part. As guests we had Mr. J. A. Gillies, of the Canadian Lumbermen's Association; Mr. Beatty, of the Laurentide-Ottawa Division of the Consolidated Paper Corporation; Mr. Franklin W. Reed, Executive Secretary of the Society of American Foresters; Mr. C. E. Behre, Dr. Perley Spaulding, Mr. P. W. Stickel of the Northeastern Forest Experiment Station of the U. S. Forest Service; Maj. G. R. Turner, Mr. A. R. Parody and Mr. S. C. D. Lawson.

"On Sunday morning, July 7th, a business meeting of the C. S. F. E. was held at which 44 members were present. Mr. W. A. Delahay presided, in the absence of our President, Mr. G. C. Piché.

"The executive Secretary reported on the position and needs of the Society and his work to date.

"Mr. J. G. Wright read a most interesting paper on the Determination of Forest Fire Hazard.

"Mr. A. Koroleff, Forester for the Woodlands Section, spoke on the need for and advisability of calling a forestry congress in the near future to arouse and focus public opinion on the necessity of a definite and workable forestry policy for the Dominion and the Provinces. Following an active discussion, it was decided to take the whole matter under consideration and a committee was appointed for the purpose.

"Mr. Franklin Reed spoke on the work of The Society of American Foresters saying that they had many problems in common with the C. S. F. E. and asked for closer relations and cooperation between the two societies. In reference to a forestry congress, he spoke of the work of the Lumber Code Committee of the NRA which was in reality a congress called to consider a very definite and important forestry problem and had functioned with great success. Of the delegates to this meeting, two-thirds were foresters and of the permanent committee of 10, 8 were foresters.

"Messrs. Delahay and Cameron spoke on the work of the Research Committee of the Society and its possibilities and asked the cooperation of the Research Council of which Gen. McNaughton has just been made President. Gen. McNaughton replied that he would do all in his power to be of assistance in forestry matters.

"The afternoon was spent in visits to the work of the Forest Experiment Station and in informal meetings.

"In the evening, Gen. McNaughton gave an illustrated talk on the acquisition and laying out of a chain of experimental areas for forest research under the Dominion Forestry Branch in cooperation with the Department of National Defense from the Atlantic to the Pacific. Seely gave an interesting paper on advances in aerial photography which was followed by a spirited debate on the relative values of line maps made from aerial photographs and mosaics.

"Monday morning was passed in inspecting the cuttings made by the unemployed men and by local men who buy stumpage.

"On the way back to camp a demonstration was given of road building machinery, gasoline and Diesel tractors, and bulldozers.

"The afternoon meeting of the Woodlands Section was held at Military Headquarters.

"On Tuesday morning trips from Ottawa were made to inspect the wood handling operations of the E. B. Eddy and J. R. Booth plants. Luncheon was a joint affair with the Technical Section. The chief speaker was the Hon. Dr. Manion, Minister of Railways and Canals. Franklin Reed commented briefly on affairs in the United States and the experiments under way there.

"There was a joint meeting of the Technical and Woodlands Sections in the afternoon and a pleasant informal dinner in the evening.

"In Ottawa, Delahay, Avery, Koroleff, Gilmour, Swaine and Ellwood Wilson had a conference with Gen. McNaughton, President, Messrs. S. A. Eagleson, Secretary, Dr. R. Newton, and Mr. F. Lathe to discuss how the National Research Council and the C.S.F.E. could cooperate and how all those interested in the forests either as governments, industries or foresters could work together for the common good."

Forest Credits

On July 5th, President Roosevelt expressed to Senator Fletcher his approval of a proposed measure for forest credits, which is intended to be an extension of the type of productive credit which the Farm Credit Act has so successfully applied to agriculture. This new forest credits proposal avoids setting up a new credit institution by enlarging the scope and effectiveness of institutions existing under the Farm Credit Act.

The tentative bill, which Senator Fletcher submitted to the President, is based upon the joint recommendations of the Forest Service and the Farm Credit Administration after exhaustive study of the entire subject by Burt P. Kirkland.

It is felt that this proposed measure is the necessary first step in the legislative program for the forest industries, which President Roosevelt has indicated publicly he desires to propose to the Congress at an opportune moment. Undoubtedly, extension of credit at reasonable rates of interest to timber owners, who desire to practice sustained yield management with their forests, is the most urgent immediate need, if forest industries are to be transformed from a basis of quick liquidation to one of permanency.

It is proposed to set up a Forest Credits Commissioner as a member of the Farm Credit Administration, supported by local and national advisory councils. Operations will be financed through a forest credit bank with a capital of $40,000,000, of which $10,000,000 will be set aside for an insurance fund. The bank is authorized to issue $200,000,000 worth of bonds, interest and principal wholly guaranteed by the government.

Loans may be made for the payment of debts for general forestry purposes, including the utilization of forest products, purchase of forest lands and properties, and for the building of transportation facilities. Loans are not to run for more than thirty years and interest rates are not to be less than 2 per cent in excess of the rate of interest borne by the last preceding issues of forest credit bonds.

JOHN B. WOODS,
Natl. Lumber Mfrs. Assn.

GOVERNMENT GRANTS AND LONG TERM REFORESTATION LOANS IN ENGLAND

A land owner desirous of practicing forestry in England, Scotland, or Wales can secure both a governmental grant and a long term loan from a quasi-public corporation.

The Forestry Commission will, on approved planting projects of not less than five acres per year, grant up to $10 an acre for every acre planted to conifers and certain approved hardwoods, up to $20 per acre for oak or ash, and up to $15 for beech, sycamore, or chestnut.

Then, the Lands Improvement Company of London, incorporated by special acts of Parliament, will grant loans to improve properties by afforestation and windbreak plantings. To secure such a loan a land owner must make application upon a prepared form; the proposal is then investigated by the company's manager and surveyor before submission to the board of directors.

If approved by that board, it is submitted with full particulars (plans, specfications, and estimates) to the Ministry of Agriculture and Fisheries, who appoint one of their commissioners to visit the property and investigate the proposal. The law specifies that the Ministry must be satisfied that the planting will effect a permanent increase in the value of the property exceeding the cost of the planting, or that the planting will maintain existing values that would otherwise be dissipated.

The loan is granted by the company only after the project is approved by the Ministry. It may run a maximum of 40 years with interest at 3¼ per cent (recently reduced from 3⅜ and 4 per cent). In addition, a commission of 5 per cent is charged on the amount borrowed. This, together with the costs of inspections and fees, is added to the face of the loan. The loan is liquidated by equal annual or semi-annual payments of principal and interest. Neither the company nor the landowner has the right to alter the terms of repayment.

In case of default, the company's claim has priority over all existing and future

mortgages. In England and Wales the owner may secure a loan without notifying any mortgagee.

P. A. Herbert,
Michigan State College.

Austin Cary Retires

On July 31 Dr. Austin Cary, Senior Logging Engineer, retired from the Forest Service. His career in forestry has been both long and notable. Starting in the '90s, when forestry in this country was at its beginning, he has had within five years of a half century of forestry experience. A keen observer and sound thinker, his outstanding contribution has been forestry that is practical—that works in the woods.

Doctor Cary secured his A.B. degree at Bowdoin in 1887 and his A.M. degree in 1890, and studied biology at Johns Hopkins and Princeton in 1888-1891. He was an instructor in the Department of Geology and Biology at Bowdoin in 1887-1888, taught during the spring terms at the Yale Forest School in 1904-1905, and was Assistant Professor of Forestry at Harvard 1905-1909. On the industrial side his experience dates back to the '90s. From 1896 to 1904 he was Forester for the Berlin Mills Company, now the Brown Company, having been cited as the first American to hold such a position with a progressive corporation far-seeing and judicious enough to plan for reforestation.

Dr. Austin Cary

In the field of state forestry he also took a significant part. For the two years 1909 and 1910 he was Superintendent of State Forests of New York. Previous to that, in 1893, he was in the employ of the Maine Forestry Commission. In his work with timberland owners in the South he was constantly mindful in the important field of state forestry and was ready to promote it.

Doctor Cary's first appointment with the Forest Service was dated March 1. 1905, the position being that of expert. His continuous employment, however, did not begin until July 20, 1910. Thus he was in the Forest Service for an even quarter century.

Although Doctor Cary spent a short time in the Northwest, the bulk of his work has been among the large timberland owners of the South and of the Northeast. He worked intimately in the preparation of management plans for literally hundreds of private owners in these sections, many of whom today give him full credit for starting them off in the untried field of scientific forestry practice. His keen grasp of practical forestry, unfailing good sense, modesty, and determination have perhaps been at the root of his almost universal success in dealing with forest landowners. His

"Manual for Northern Woodsmen" has been printed in several editions and he has been a large contributor to technical and trade journals.

A Fellow of the Society of American Foresters since 1924, Doctor Cary has long been an active and loyal member. His many contributions to the JOURNAL OF FORESTRY have made him well known to the members of the Society to whom his thoughtful and vigorous handling of important forestry matters has been a continual source of inspiration.

May his remaining years be many, and may they be filled with good health and happiness. We hope and believe that his contributions to forestry will not come to an end with his retirement from active employment in the Forest Service.

A. B. HASTINGS,
U. S. Forest Service.

FOREST SERVICE MAY USE RENTED ACRES IN SHELTERBELT PROGRAM

Under an AAA agreement, the Forest Service may use, in its shelterbelt program, acres taken out of basic crop production under AAA contracts. Contract signers would continue to receive, for the duration of the contract, regular AAA rental payments for any land thus taken over. The agreement is permissive only. The Forest Service would use only acres adapted to its shelterbelt project. Farmers will be at liberty to accept or reject the offers of the Forest Service.

Two phases of the shelterbelt project involve AAA cooperation. They are strip planting and farmstead planting. About 1,300,000 acres would be required for strip planting.

The second phase of the project is farmstead planting, which provides for small woodlots and for trees around farm buildings. It would affect a minimum of 900,000 acres. The Forest Service would agree to supply the trees and plant them. The landowner would agree to keep cattle out and otherwise maintain the new woodland. He would receive AAA rental payments, as in the case of strip planting, on acres covered by production control contracts. There would be no provisions for a continuing Forest Service control of farmstead woodlots, or for eventual purchase.

HANDLING AND FILING INCREMENT CORES

The collection and preservation of increment cores always presents somewhat of a problem, owing to difficulty in keeping them intact and in properly labelling and classifying them.

During a study of the locust borer (*Cyllene robiniae* Forst.) at the Central States Forest Experiment Station a large number of increment cores have been col-

Fig. 1.—Filing increment cores.

lected, and a very simple but convenient method has been devised for handling and filing them. Sheets of corrugated paper 8½ x 10 inches are mounted on stiff cardboards 9½ x 11¼ inches, leaving sufficient border for labeling each core (Figure 1). These are taken into the field when the cores are to be collected. Rubber cement is spread in the grooves of the corrugated board, and the cores are pressed into the grooves immediately upon removal from the tree.

This method does away with much loss and breakage, and with confusion resulting from difficulty in labelling. Even if a core is broken on removal from the tree, it can be just as readily mounted. Eight of these cards can be put into an expansible fiber filing envelope (Figure 1) of standard size, which will fit into a regular letter-size file. Thirty or more cores may be mounted on one card, thus making them easily available for later reference and study.

R. C. Hall,
Central States Forest Exp. Sta.,
U. S. Forest Service.

The Effects of Eleven Inches of Rain on the Stuart Forest Nursery

On the night of May 18, 4.46 inches of rain fell at the Stuart Forest Nursery near Alexandria, La. This was followed by 6.26 inches during the night of May 19, a total of 10.72 inches for the 36-hour period. The approximate duration of each rain was 6 hours. There was no intervening precipitation. High winds, accompanying the rain, blew down numerous trees nearby. The 8-million-gallon reservoir from which the water for the nursery is supplied was filled to capacity.

A reconnaissance on May 19 revealed no conspicuous damage. Slight washing of the beds, sedimentation of the paths, and cutting of the ditches were observed, but few seedlings were lost. A survey the morning of May 20, however, revealed a situation somewhat more serious. Bad erosion of the edges of the beds had occurred, entailing an estimated loss of one million seedlings. Many of these seedlings were completely uprooted, others were prostrate with two thirds of the roots exposed. This occurred in spite of a 4-inch shoulder left unsowed on each side of the beds as a safety factor.

Sedimentation of the paths between beds was common, and reached a point of complete filling in a few places. Ten days' work of one man with a plow was required to reopen these furrows. Besides this, some shovel work was necessary to build up the ends of beds and small eroded spots. It should be noted here that the amount of damage from silting was less important than the character of the damage. The soil at the Stuart Nursery is a very fine sandy loam with a heavy clay subsoil. The portion of the soil carried away was the darker, more friable part, leaving behind the sandier fractions. Besides losing the more desirable part, rebuilding the shoulders with the sandy element leaves the beds in a weakened condition, subject to subsequent erosion.

The losses at the nursery may be attributed to causes largely beyond control. While the climate of the region is such that heavy rains are expected, two rains of such magnitude within so short a period are unusual. As the reconnaissance of May 19 showed, no material damage was done by the first rain, but the second, following immediately, while the soil was water-logged and soft, wrought havoc.

The period in the growing season at which the rain fell was intermediate in effect. Had this rain occurred later in the season when the seedlings would be hardier and the shoulders more firmly

packed by weeding operations, much less damage probably would have resulted. However, had the rains occurred during the germination period, just after the burlap mulch was removed and before the beds were settled, the results might have been catastrophic. As is was, loose seed (mostly not viable) accumulated abundantly in drifts.

The topography of the nursery favors good drainage. Slope varies from 1 to 5 per cent; artificial ditches follow natural drainage features.

The 1935 capacity of the Stuart Nursery is 35 million seedlings. This means a loss of about 3 per cent in the number of seedlings. Assuming a conservative figure of 75 cents per thousand for their present value, $750 were added to the debit side of the ledger in two days, besides the expense of repairs and the disorganization involved.

The above facts are presented to show that even in a nursery with an adequate drainage system, damaging rains can result in a critical situation. In addition to providing adequate main water outlets, all nursery personnel should be alert to the importance of proper bed preparation. This includes careful attention in making up shoulders, the avoidance of sinks and swells in the beds and water pockets in the paths, and the early checking of incipient gullies. Where there is the danger of recurrence of such rains, especially in the early part of the growing season, the nurseryman would do well to consider the use of wooden curbs for the protection of his beds.

A. D. McKellar,
Southern For. Exp. Sta.,
U. S. Forest Service.

REVIEWS

Corticas, Contubicao Para o Estudo do Melhoramento de Qualidade. With resume in French. (Cork, a Contribution to the Study of the Improvement of its Quality). By Vieira Natividade. *143 pp., illus. Portuguese Dept. of Forests and Waters, Lisbon, Portugal. Vol. I, No. 1, 1934.*

It is something over half a century since botanists worked out the modification of structure of the cork cambium in the cork oak (*Q. suber*) which accounts for the fact that the outer bark (cork) may be removed periodically from the tree without appreciably injuring it and permits the tree to produce another outer bark layer, that is to say, another crop of cork.

Few cork growers or merchants concerned themselves with these interesting facts. Although they formed the basis of an important industry, they answered no questions as to the reasons for the enormous variations in the quality of cork (far greater than in wood of a given species) or the baffling problems of why cork from different districts, or from different trees in the same district, varies so widely in qualities and values. The cork trade has simply had to take the cork as it came from the tree and classify it in a bewildering number of grades on superficial qualities corresponding to technical and trade requirements. In addition to all this, there has grown up a large body of entirely unproved assertions as to the cork qualities inherent in cork of various regions and districts.

Senhor Natividade of the Portuguese Forest Experiment Station at Leiria has attempted, in the work under review, to resolve order out of this confusion. If his conclusions stand the test of further study, and can be applied in practice, they should succeed in so doing.

First, he has studied cork of different qualities and grades under the microscope from a histological and physiological point of view to determine what the variations really consist of and why they occur; in short, a sort of wood technology study of cork. Second, he has made suggestions for improving the quality of cork by the selection of high quality trees for propagation purposes.

Senhor Natividade seems to show conclusively that the number of lenticles in the bark, "pores" in the cork trade. and the amount of ligneous tissue, which projects itself from the periderm into the cork, are the essential factors which determine cork quality. Form and size of the cells themselves have little to do with it. The importance of the pores as an index of quality and determination of perosity are commonly recognized in the trade, and are perhaps the only rational basis of some of its grading rules. They can be determined by the naked eye. The amount of ligneous tissue, which determines compressibility, ease of working, etc., has not been well understood, except that the expression "woody" is often used to describe cork which lacks compressibility. It is not easily taken account of in ordinary grading practice.

Senhor Natividade claims that these defects are inherent in the tree, and are not affected by the conditions under which it is grown. Many cork men and probably some foresters, familiar with the cork oak, may not agree. The reviewer would be inclined to agree, al-

though rapidity of growth unquestionably affects other qualities not covered by the statement.

The bulletin claims that the great variations of quality comes from the facility with which the cork oak hybridizes. There are several well known hybrids with other oaks growing in the cork producing regions, and botanists recognize many varieties within the species itself.

The writer's practical conclusion is that by isolating a good quality strain, namely, one with a minimum of lenticles and ligneous tissue, and using it for artificial reproduction, the forests could be graded up to high-quality production. Recognizing the difficulty of controlling seed quality from a species where varieties are innumerable in a given region, he proposes vegetative reproduction to insure planting stock of proper quality from intrinsically high-quality trees.

Since it is relatively easy to produce planting stock from cuttings of this species, the method would have possibilities, granting the basic soundness of Senhor Natividade's studies.

P. L. BUTTRICK,
Torrington, Conn.

Replacement of the Chestnut in Pennsylvania. By John E. Aughanbaugh. *The Pennsylvania Department of Forests and Waters. Bulletin 54. Pp. 38. 1935.*

When the chestnut blight (*Endothia parasitica*) first began to spread its devastation, few foresters looked upon the apparent calamity as an object lesson in the advantages and disadvantages of heavy thinning. Twenty-six years have elapsed since the blight was first recognized in southeastern Pennsylvania. During that period the chestnut as a valuable forest tree has become practically extinct throughout its natural range. The forest community in the interim has been adapting itself to the loss of one of its silvically most important members.

In 1930 John E. Aughanbaugh, a research forester in the Division of Research, began to study the extent and significance of this adaptation. The study was started in the Mont Alto State Forest, the field laboratory of the Department of Forests and Waters, because that area and the near-by Michaux State Forest exemplify the oak-chestnut-hard pine stands of the state. About 3,000 study plots were established in regions where the chestnut was formerly abundant.

Treating the blight damage as an exceedingly heavy thinning, Aughanbaugh found a decided growth acceleration among the chestnut's former associates. The removal of chestnut competition increased by 80 per cent the diameter growth of the remaining trees during the first decade of release. Although this stimulated growth is encouraging in itself, the growing stock had been so seriously depleted in stands where chestnut made up the bulk of the stumpage that a deficiency of from 5 to 35 per cent exists. In stands where chestnut comprised less than 10 per cent, however, the volume is greater than before the attack.

More than 40 per cent of the advance growth and 30 per cent of the reproduction are made up of rock oak and red maple. Reproduction in chestnut openings is composed largely of undesirable species. This high proportion of less desirable trees is probably the combined results of clear-cutting, fires, timber culling, and the blight. Judicious use of the axe, intensive fire protection, and supplemental planting with desirable species are recommended as possible expedients to increase the quality of such stands.

The chestnut itself has played an important role in the regeneration of blight-made openings. Recurrent sprouting from old stumps and the establishment

of new seedlings are indicative of its tenacious struggle for existence. Each successive crop of sprouts appears to be slightly more blight resistant than the former one; and unless there is a decided recrudescence of the disease, the chestnut may again after many years of suppression become an important tree in the East. The regaining of its former status, however, is something to be hoped for rather than expected.

One cannot hope to cover, in a brief review, the vast amount of detailed work that Aughanbaugh has accomplished in the past five years. The bulletin is recommended to all foresters, and particularly to those interested in the development of regions where the death of the chestnut has added serious economic, biological, and silvical problems.

ALBERT G. HALL,
U. S. Forest Service.

A Physiological Study of Dormancy in Tilia Seed. By J. Nelson Spaeth. *Cornell University Agricultural Experiment Station Memoir 169, Ithaca, New York. 78 pp. 1934.*

The seeds of basswood (*Tilia* spp.) have long been known to germinate poorly, for causes which have been imperfectly understood. In order to establish the facts concerning the dormancy of basswood seeds and to devise means of obaining prompt and abundant germination, the author studied nearly 50,000 seeds from New York, Wisconsin, and Indiana during 3 years. Whole fruits, intact seeds, naked kernels, modified naked kernels, and excised embyos were used. The effects of refrigeration and stratification in the greenhouse, laboratory, and out-of-doors were studied. Seeds were treated with sulphuric acid, hot water, liquid air, carbon-dioxide snow, and ether, alcohol, ether, ethylene-chlorhydrin vapor, illuminating gas, oxygen, hydrogen peroxide, thiourea, and x-rays. Absorption from sucrose, dye, and inorganic salt solutions was involved in permeability studies.

The pericarp was found not to be impermeable, but must be removed in order to treat the seed coat. The author used concentrated nitric acid partially to digest the pericarp. Impermeability of a layer in the outer part of the palisade cells of the seed coat was found to be a primary cause of dormancy. Treatment with hot waer, abrasion, and carbonization with acid render the seed coats permeable to water, but hot water kills the embryo; abrasion is less uniform than is acid treatment and is fellowed by more decay in stratification. From 10 to 30 minutes in concentrated sulphuric acid rendered the seed coats permeable without injury. Many other methods were tried but were found to be ineffective or injurious. Germination of acid-treated seeds took place in moist stratification at temperatures of from 0° to 10° C. (32° to 50° F.) in from 110 to 130 days. In such seeds the rate of germination is increased greatly by transferring them, as soon as germination starts, to temperatures above 20° C. (68° F.).

In order to obtain a high germination percentage of basswood seeds in practice, the author recommends the following procedure: (1) procure seeds which have a high viability percentage; (2) store fruits air-dry until 4 or 5 months before planting time; (3) extract seeds from thoroughly air-dried fruit with concentrated nitric acid; (4) render seed coats permeable by 15 to 20 minutes treatment with concentrated sulphuric acid; (5) stratify in moist sterile peat moss in open containers at 2° to 5° C. (35.6° to 41.0° F.); when germination starts transfer seeds to nursery beds.

A brief discussion of the anatomy of the basswood fruit and a review of the

literature pertaining to the mechanism of dormancy and methods of hastening germination, after-ripening, and the physiology of germination are very helpful in rendering the results of the present study more interesting and understandable. Many foresters would doubtless have found the bulletin more appealing had the temperatures been expressed in degrees Fahrenheit instead of in Centigrade.

For those readers who dislike the acid-treatment method attention is directed to the work of Barton,[1] who found that the seed coats of basswood were rendered permeable by storage in moist granulated peat moss at 20° C. (68° F.) for 4 months. An additional 5 months at 1° or 5° C. served to after-ripen the embryo.

Before the foundations for a rational practice of silviculture have been thoroughly and solidly laid the results of many other basic researches similar to the one under review, should be available.

C. F. Korstian,
Duke Forest.

[1]Barton, Lela V. Dormancy in Tilia seeds. Contr. Boyce Thompson Inst. 6(1):69-89. 5 figs. 1934.

CORRESPONDENCE

Editor, *Journal of Forestry.*
DEAR SIR:

A letter by Mr. Wade De Vries in the July number of the JOURNAL commented on my article in the May number, entitled Carrying Capacity of Timber Operations for Sustained Yield.

It is very evident that I did not make myself quite clear in some respects. The purpose of the article first of all was to demonstrate a method of arriving at carrying capacity. The figures used as stated in the article were merely sample figures, so the method could be shown. An attempt was made only to keep the figures within reasonable range of those actually paid or assessed.

I am quite aware of the fact that the property tax is an ad valorem tax based on the valuation of the timber. This fact is of importance in making a settlement on tax rates, but after the tax is once paid it is of no more importance to the operator or corporation accountant. If an operator has 100,000 M feet of timber and pays $3,000 taxes he is only interested in the fact that his taxes amount to an average of 3 cents per M, although they might vary from 1 cent to 5 cents depending on the quality and accessibility of his timber. If he is cutting 5,000 M feet per year the operator is confronted with a cost of 60 cents per thousand on his annual cut for taxes. Paying taxes after all is an annual affair which must be a charge against his profits per unit of production. The fact that the more accessible timber is taxed at 5 cents and the inaccessible at 1 cent is of no consequence in calculating his costs.

The 3 cent rate used in the article was an average rate per thousand feet for a carrying charge. This rate corresponds rather closely to the amounts which are paid in many operations in the West. A check-up of about fifty billion feet showed that the average rate was 2.2 cents. The rates varied from less than 1 cent to 5 cents.

The 75 cent rate applied in the severance tax is again a sample figure which was applied for the purpose of demonstrating the method. The figure used was within reason as compared to an actual charge. In checking over a cut of about one and one-half billion feet the last year in which the lumber industry generally made money, it was found that the timber taxes on basis of production amounted to approximately 79 cents per thousand. Subsequent to that year the taxes became very much higher, in some cases as much as $2 or $3 per thousand. During this later period the industry generally lost money and found itself in financial difficulties. It is true that other factors besides taxes contributed to the difficulties; however, it does appear that a 75 cent severance tax might be applied under normal conditions. More taxes were collected under the 79-cent rate mentioned above than under the higher rates of succeeding years, as the higher rates simply brought on a lot of tax delinquency.

Whether a tax of 75 cents per M is collected by means of a severance tax or by some other method of taxation is of no great consequence to the operator. What he is particularly interested in is the fact that the tax be reasonable, that

it be fairly stable, and that it be paid out of income. No industry can survive if its taxes are paid out of capital. This is the situation in much of the lumber industry at present.

The severance tax, from a purely forestry standpoint, is still the ideal tax. The objections raised by the Inquiry were objections from the standpoint of administration and public finance. The severance tax has never been applied to mature timber nor been administered over a large area such as a region or a state.

The public generally seems to favor sustained yield operation. In order to carry on sustained yield it is absolutely necessary that the taxes be closely coordinated with income. Income must be derived at the time of operation, If taxes are collected from capital the operator goes broke and the sustained yield plan passes out of existence.

If a severance tax on mature timber were to be applied on a regional basis and administered by a central taxing power, the taxes collected could be allocated to the poliical subdivisions as desired. As these taxes must come from the income of the operations it appears that this method might produce as much tax as at present. It might also be a real stimulant to sustained yield. I realize that there is no definite proof on either side of this question, and that it finally gets down to a matter of opinion.

In demonstrating the method for carrying capacity the severance tax was also used to show that more than one method of taxation could be calculated and comparisons made. As the property tax and the severance tax have been so largely discussed with respect to timber, it was felt that the method advocated would be more easily understood by using these two well known methods of taxation than by using any of the recommended plans of the Inquiry.

In closing I wish to say that I have no quarrel with the Tax Inquiry as to their recommendations. I believe, however, that with our present trend toward combination of political units, greater centralization of tax administration, and the public desire for sustained yield operation, many of the objections raised against the severance tax may be overcome.

E. T. F. WOHLENBERG,
San Francisco, Calif.

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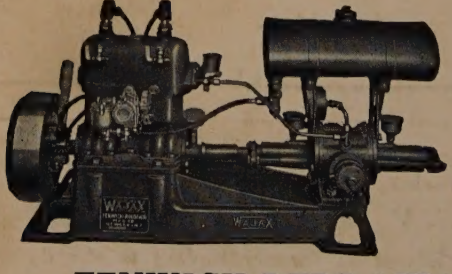

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